An Institutional Perspective on the Energy, Water and Food Nexus in Australia

by

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Certificate of Original Authorship

I, Kristy April Mamaril declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Information, Systems and Modelling, Faculty of Engineering and Information Technology, at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise reference or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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Abstract

The security of Energy, Water and Food (EWF) – fundamental human needs – has become an emerging concern because of population and economic growth pressures and climate change impacts. Redressing EWF security is however a challenging task, primarily because of the complex web of interlinkages between EWF (the Nexus), and EWF and the wider economy and polity. A pre-requisite therefore for redressing EWF security is an insightful understanding about the nature of the nexus, and the design of efficacious EWF institutional settings that are informed by nexus considerations and are capable of balancing various interests. While considerable effort has been devoted to understanding the physical and economic dimensions of the EWF nexus, much less so on the institutional dimension. Against this backdrop, the main objective of this research is to develop an institutional perspective on EWF nexus in the context of Australia – the country of focus of this research. To achieve this objective, an analytical framework based on (four) *Levels of Institutional Analysis* has been developed in this research. This framework draws its imprimatur from the basic tenets of *Institutional Theory*, more specifically *New Institutionalism* that recognizes the interdependence between institutions and economic outcomes, and is aligned with neo-classical reasoning. This framework is employed in this research particularly to understand the degree to which (formal and informal) institutions in Australia have promoted a culture of 'cross-sectoral governance' of EWF – at the national and state levels, and across five distinctive time phases since the beginning of colonial settlement in 1788 to the present. The analysis suggests that although there has been a general awareness about the nexus between EWF, and in a select few cases, evidence of nexus-informed thinking, such awareness and effort has however failed to translate into the emergence of coherent and lasting institutional settings for jointly governing EWF. Consequently, EWF governance in Australia remains essentially siloed – driven by narrow, sector-specific considerations, economic imperatives and political expediency. Further, such siloedness is pervasive, transcending the political divide, institutional levels and federal-state jurisdictional contrasts. This research has also delineated the broad contours of a nexus-informed institutional and governance landscape for EWF, and made some practicable suggestions to transition towards long-term nexus-based governance to better redress EWF security challenge. Besides establishing the centrality of nexus considerations in the context of EWF security, this research should also serve as a sound platform for engendering public policy debate on other contexts typified by multiple interlinkages.

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Abbreviations

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ACT	Australian Capital Territory
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ALP	Australian Labor Party
ANZEC	Australian and New Zealand Environment Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AWA	Australian Water Association
AWC	Australian Water Council
AWRC	Australian Water Resources Council
BOM	Bureau of Meteorology
CFI	Carbon Farming Initiative
CLP	Country Liberal Party
COAG	Council of Australian Governments
COM	Commonwealth
CON	Conservative Party
COU	Country Party
CPI	Consumer Price Index
CPNP	Country and Progressive National Party
DEE	Department of Environment and Energy
DIRD	Department of Infrastructure and Regional Development
ER	Electoral Reform League
EWF	Energy, water and food

FAO	Food and Agriculture Organisation
FT	Free Trade Party
GATT	General Agreement on Tariffs and Trade
GL	Gigalitres
GWh	Gigawatt hour
IC	Industry Commission
IEA	International Energy Agency
IGA	Intergovernmental Agreement
LCL	Liberal and Country League Party
LIB	Liberal Party
LNP	Liberal National Party
MDB	Murray-Darling Basin
MDBA	Murray-Darling Basin Authority
MIN	Ministerialists
ML	Megalitres
MRET	Mandatory Renewable Energy Target
NAT	National/Nationalist Party
NAT LAB	National Labor Party
NAT PROG	Nationalist Progressive Party
NCP	National Competition Policy
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NEPP	National Energy Productivity Plan
NESA	National Energy Security Assessment
NFWS	National Food Waste Strategy
NRMMC	Natural Resource Management Ministerial Council
NSESD	National Strategy for Ecologically Sustainable Development

NSW	New South Wales
NT	Northern Territory
NWC	National Water Commission
NWI	National Water Initiative
NWI	National Water Initiative
NWQMS	National Water Quality Management Strategy
OECD	Organisation for Economic Co-operation and Development
PC	Productivity Commission
PJ	Petajoules
PMSEIC	Prime Minister's Science Engineering and Innovation Council
PROT	Protectionist Party
QLD	Queensland
REF	Reform Party
RET	Renewable Energy Target
SA	South Australia
SMA	Statutory Marketing Authority
SUP	Support from parliamentary factions and independents
TAS	Tasmania
UAP	United Australia Party
UCP	United Country Party
UN	United Nations
VIC	Victoria
WA	Western Australia
WPI	Wage Price Index

Chapter 1 Introduction

1.1 Background

The world is experiencing population and economic growth. According to the United Nations (UN) (2017), by 2050 the global population is projected to reach 9.8 billion people. Many will live in rapidly industrialising emerging economies where their overall living standards are expected to increase. Rising levels of migration, particularly from rural areas to urban areas, are changing human settlement patterns, resulting in high levels of urbanisation across the world and this is shaping modern lifestyles. Advances in technology are also shaping lifestyles as this is seen to make life easier and enable people to be more productive. The world continues to globalise, societies continue to modernise and economies continue to pursue growth in the hope that livelihoods will improve and humanity will progress. These trends for the next few decades will characterise global growth and development.

Current debate however suggests that this global growth, although seeming to paint a positive picture of human progress, has become a genuine concern. This is seen particularly in light of its contribution to environmental damage, highlighted in the 1987 Brundtland Report entitled 'Our Common Future' (Brundtland 1987) and social and economic inequality. Growth is placing increasing pressure on the world's existing resources and this is eroding the capacity with which the world accommodates the human population and their modern lifestyles. Human activity and over-exploitation in the pursuit of economic growth at any cost has caused pollution, land degradation and a loss of biodiversity, resulting in a significant depletion of much needed natural resources. Society's reliance on fossil fuels has contributed to climate change, adding to the uncertainty of the planet's natural environment and ecosystems and increasing the vulnerability of the human population. Natural cycles, such as water cycles including rainfall are becoming less predictable, hampering the production of food and access to water.

1.1.1 Energy, water and food security challenge

One area of emerging concern is the security of energy, water and food. Energy, water and food are basic needs and their security has become threatened by continued growth patterns coupled with environmental degradation and climate change. It has become increasingly difficult to support an expanding population whose rising prosperity requires greater amounts of resources that are becoming increasingly scarce, in particular, energy, water and food.

By 2040, energy consumption is expected to increase by 28% (U.S Energy Information Administration [EIA] 2017, p. 5) and by 2050, water and agricultural demand is expected to increase by 55% (OECD 2012, p. 24) and almost 50% (Food and Agriculture Organisation of the United Nations (FAO) 2017), respectively. However, according to Valin et al. (2014) food demand by 2050 may increase anywhere between 59% to 98%. By 2050, global electricity demand is forecasted to increase by 57% (Bloomberg New Energy Finance 2018). As a result of intensifying water cycles, it is also estimated that by 2050, between 4.8 and 5.7 billion people, more than half of the global population, will be living in water scarce areas (UN 2018, p. 3). In 2016, although there have been substantial improvements, 1.1 billion people still lacked access to electricity (International Energy Agency [IEA] 2017, p. 39). According to the World Health Organisation (WHO) and the UN Children's Fund (UNICEF) (2017), almost 2.1 billion lacked access to safely managed drinking water services in 2015. In 2017, the number of undernourished people increased to nearly 821 million, rising from 804 million in 2016 (FAO, IFAD, UNICEF, WFP & WHO 2018, p. 2). These statistics reinforce the need to achieve energy, water and food security.

The health of society and the economy is highly reliant on energy, water and food such that humanity's future progress will be dictated by its ability to ensure energy, food and water security. There is much concern over how humans must address energy, water and food security challenges and govern the resources available to them to not only meet the needs of the expanding population but to safeguard them for the future.

Ensuring energy, water and food (EWF) security is a challenge for all countries, regardless of the stage of development, income, growth and place, particularly as countries become increasingly interdependent through globalisation. Rising prices, conflicts with trading partners, growing dependencies in trade and investments, changing natural environment and climate change are issues various countries experience at different levels of severity. For the least developed and poorer regions, worsening insecurity can exacerbate poverty and famine, hindering their social and economic development. For these countries, insecurity has been a prevailing concern regarding access to these basic needs. For developed countries, much of the focus is on operating more efficiently and productively, managing increasing import dependencies, maintaining affordable prices as well as ensuring the consideration of environmental concerns which developed countries may have greater scope to address.

Redressing EWF security challenges is imperative as failure to properly do so could lead to severe ramifications, not only in terms of social unrest, political conflict, economic instability, environmental damage and growing geopolitical tensions, it has the potential to threaten human existence.

Without proper solutions, insecure energy, water and food can lead to serious economic, political, geopolitical, social and environmental implications. It can threaten the stability of nations, regions and the globe as a whole. For instance, from 2006-2008, dramatic increases in the global price of food and oil led to economic instability, increased poverty rates and worsened global food insecurity. As a result, countries in Africa such as Egypt, Tunisia, Burkina Faso and Senegal, to name a few, experienced violent street protests, food riots and overall social unrest (Berazneva & Lee 2013). In 2007 in Egypt, high food prices and inaccessibility contributed to great political discontent which had the impact of ending the 30-year rule of Egypt's former President Mubarak (Berazneva & Lee 2013, p. 35). Furthermore in 2011, 184 000 Somalis migrated to neighbouring countries as a result of drought and water and food insecurity (UN Water 2013, p. 8). These instances demonstrate the seriousness of insecurity.

EWF security is a global issue. Recognition of the importance of redressing EWF security challenges is also reflected in the UN Sustainable Development Goals with goals for zero hunger (Goal 2), clean water and sanitation (Goal 6) and affordable and clean energy (Goal 7) amongst other goals to improve global well-being. The costs of worsening EWF security are high in terms of greater poverty, social unrest and economic instability (Grey & Sadoff 2007) but most significantly in terms of human life on Earth which is indeed under threat should no appropriate action be made to redress security challenges. In the long term, worsening EWF security will constrain any country, irrespective of its economic wealth.

A challenging task

EWF security is a global priority. The prevention of the many negative consequences and outcomes that may arise from worsening EWF security calls for effective policies and implementation strategies. However, developing these policies and implementation strategies is a challenge because EWF security is a complex issue.

Firstly, EWF security is context specific as it differs across regions, countries and communities. The unequal spatial distribution of natural resources, differences in geography and environment, in political and economic systems and in culture and social behaviour lead to differences in EWF security issues. Further, EWF security can be viewed from various levels (global, regional, sub regional, national, sub-national, local and individual) with linkages to the wider society and economy.

Secondly, EWF security is multi-dimensional. EWF security is influenced by a variety of factors (economic, social, political, geographical, geo-political, environmental and cultural). Furthermore, security can also be subjective, depending on how individuals and communities

perceive security and interpret security risks. This is based on specific values and beliefs held by different individuals and communities.

Thirdly, EWF security is dynamic and evolves over time. EWF security is not a static issue. Changes in political and economic systems, social and cultural behaviour and ecosystems can all lead to changes in EWF security. Changes can be planned, such as through policy and strategies or unplanned, such as through natural disasters, economic or political crises, creating uncertainty and further complexity with regard to redressing EWF security issues.

Finally, EWF securities are interconnected because of the interlinkages between EWF, what has been described as an EWF nexus. Put simply, energy is needed in the production of water, in extraction, pumping in storage and in treatment, while water also plays an important part in energy production through the cooling of thermal and nuclear power plants and in the generation of hydropower. Water is a key input into the production of food and energy is necessary for irrigation, harvesting, manufacturing and the transport of food. Food resources such as agricultural land can be used for both food and energy purposes for example, growing biofuels from either food or non-food crops or, if agricultural land is energy-resource rich, this could result in the loss of agricultural land for energy-resource extraction. Competition between sectors for resources is likely. To complete daily tasks, individuals simultaneously require these three resources, for instance both water and energy are needed for cooking purposes and they are also needed for other household purposes, such as lighting, heating, showering and for general living requirements.

In light of the aforementioned characteristics of EWF security, it is clear that ensuring EWF security is a complex task. To sensibly redress the EWF security challenges, these fundamental characteristics must be taken into account. While all characteristics are important, the focus of this research however, is on the interconnectedness, that is the 'nexus' characteristic of EWF security. Other characteristics will be addressed within the context of the EWF nexus.

Energy, water and food (EWF) Nexus

Within the last decade, particularly since the 2011 Bonn Conference on the Water, Energy and Food Security Nexus, there has been a growing amount of attention on understanding the inter-linkages between EWF and their securities. This is seen in the rapidly emerging literature on the EWF nexus.

As previously described, the EWF nexus refers to the inextricable linkages between EWF. The interconnectedness between EWF has become increasingly apparent as a result of resource scarcity, leading to rising competition for resources, trade-offs and the pursuit of cross-sectoral efficiencies to optimise the way in which EWF is used and consumed (Ringler, Bhaduri &

Lawford 2013). The apparent resource scarcity has further placed limits on the ability to achieve economic and social goals.

The perception of resource scarcity and the associated EWF security challenges is one of the main drivers behind the consideration of the nexus, particularly as the forces of growth (population and economic) and climate change continue to exacerbate scarcity. Another driver includes the interrelated impacts on the environment and ecosystems that provide these important resources. Given these interconnections and the growing need to address trade-offs and manage rising competition for resources (between sectors and economies), greater attention is being placed on developing an integrated approach towards managing EWF to address the inherent interdependencies as well as environmental impacts (Lawford et al. 2013).

The concept of the EWF nexus has been promoted to address the challenges of ensuring EWF security, stressing the need to consider the interconnections between EWF. The concept emerged from the criticisms of the current approaches to redress EWF issues where securities are treated in isolation, in 'silos', concentrated on sector-specific securities. For example, Ringler, Bhaduri and Lawford (2013, p. 621) stated that 'despite the strong linkages between energy, water and food, practitioners and policymakers continue to approach development programs and policies in the 'silos' of their respective ministries'. In a UN report on the Water, Food and Energy Nexus in the context of Central Asia and Mekong, it was found that the energy and water policies and policy frameworks are 'developed largely in isolation from one another' (2013, p.7). Bazilian et al. (2011, p. 7902) stated that 'silo thinking' in terms of EWF is often encouraged by 'different vocabularies, competing priorities, institutional capabilities and regulatory regimes between the three areas' (EWF) and it is also due to that fact that there are 'few experts' in all areas.

With little consideration of the interconnectedness between EWF, the primary concern is that policies for EWF, including policies to redress EWF security may deliver unexpected outcomes as the implications of EWF linkages are not taken into account nor are they planned for. Rasul and Sharma (2016) criticised sectoral approaches as competing with each other and being counterproductive, particularly in the context of adapting to climate change. Such approaches ignore the existence of externalities and transaction costs (Mirzabaev et al. 2015). For example, a certain policy directed towards improving energy security may negatively impact water security which can then compromise food security. While trade-offs exist, positive synergies may also exist where certain policies directed at one resource lead to improved security outcomes for the other resources. Incorporating considerations of the EWF nexus in policy making could, for example, delay the development of, as well as the need for, costly large-scale infrastructure, enable the understanding of flow-on impacts with the potential to strengthen policies to achieve

multiple sector goals and this could result in substantial savings of resources (money, time and effort) as well as avoiding unnecessary negative impacts.

The 'nexus-based approach' aims to recognise the linkages and interactions between EWF in EWF policy-making to either avoid any potential negative externalities on other securities or to harness any potential positive externalities.

1.1.2 The need for research

Over the last couple of decades, the literature on the EWF nexus has emerged with a focus on understanding the linkages between EWF. A number of studies have been undertaken in a variety of contexts on multiple scales – at country, regional and local levels and in particular, at the water basin level with many studies capturing water interactions with energy and food (in particular, concerning hydropower and irrigation). The studies reviewed covered both developing and developed country contexts although with the majority set in developing countries.

The types of analysis undertaken have sought to identify and quantify linkages (e.g., input relationships and efficiencies and price linkages), measure the impacts of external factors on EWF systems (e.g. impacts of climate change) and assess policy options for EWF with an emphasis on modelling techniques for the analysis of various scenarios and policy pathways. Methodological frameworks have included both existing (e.g. life-cycle analysis, economics) and newly developed integrated EWF nexus-based frameworks (e.g. The Water, Energy and Food Nexus Tool 2.0 by Daher and Mohtar (2015), Water, Energy and Food Optimization Framework (WEFO) by Zhang and Vesselinov (2017) and Climate, Land, Energy and Water (CLEWS) Nexus framework by Hermann et al. (2012)).

The EWF nexus is multidimensional, and emphasis on certain dimensions (physical, economic, environmental, social, cultural and political) typically reflects the perspective of EWF nexus studies. Studies were either concerned with cross-sectoral efficiencies (input efficiencies), economic impacts and environmental impacts as well as social aspects. Amongst the existing EWF nexus studies, a large proportion of the literature has focused on the physical dimensions of the EWF nexus. There has been less coverage of the institutional and governance dimensions of the EWF nexus. Despite discussion in the literature of the importance of proper institutions and governance systems in resolving EWF security challenges, few studies elaborate on and discuss institutions and governance dimensions in-depth.

The argument that underpins the importance of EWF nexus is that current approaches for dealing with EWF are siloed, that EWF are governed separately, and therefore there is a need to shift towards more integrated approaches — those that can take into account the interdependencies between EWF. These integrated approaches to EWF are not only needed for the analysis of EWF

domains to inform policy but in the governance of EWF to enable and support new policy and this may require a change in the institutional settings for governing EWF.

While there is an abundance of literature that focuses on developing integrated approaches for the analysis of EWF to inform policy, less attention has been given to the institutional and governance structures that are needed to support integrated policy-making. Existing literature has provided little to inform new approaches to governing EWF considering what the EWF nexus means for governments. Although the current literature insists there is a need for change and attention is placed on promoting cooperation, collaboration and coordination amongst policy-making spaces, this is however only vaguely discussed. While Gain, Giupponi and Benson (2015) state that integration can occur in the policy-making cycle, the challenge of bringing together otherwise separate sector experts and policy-makers as well as understanding the barriers to cooperation and reasons for existing siloed approaches remain unaddressed in the literature.

Of the very few studies that have explored the institutional and governance dimensions of the EWF nexus, various institutional aspects were covered and these included policy, governance structures across multiple levels, jurisdictions, spatial scales and value chains, law, regimes, actors, the role of organisations as well as the importance of political and social contexts.

While these studies are useful, they are however fragmented, characterised by differences in the definition of institutions with no unified framework for the types of analysis undertaken. There is no comprehensive analysis of governance dimensions, limited to mostly discussion of policy with less attention on broader governance aspects, for example, the role of actors (organisations and other entities), rules (legislation and regulation) and the broader influence of the political environment and government involvement.

The disproportionate attention to institutional dimensions and the lack of coherent discussion gives rise to the need for further research. The redress of EWF security challenges, through more appropriate policy and implementation strategies, as contended, is underpinned by the institutional settings for governing EWF (resources, sectors and securities). Therefore, an understanding of institutional dimensions will enable deeper insights into how to better redress EWF security.

1.1.3 Developing an institutional perspective

By developing an institutional perspective on the EWF nexus, this research intends to contribute to the emerging literature. An institutional perspective on the EWF nexus is one that focuses on the institutional settings for the governance of EWF, considering the important components involved in governing EWF and the potential reasons for siloed approaches.

As discussed above, criticisms that EWF are treated in isolation implies inadequacy of institutional settings which are geared towards siloed approaches to EWF rather than providing a framework for which EWF can be governed jointly, that is a 'nexus approach', where the trade-offs and synergies that arise can be accounted for.

An understanding of the nature of these institutional settings in governing EWF is limited. Thus, there is little understanding of the role of institutions, how institutional settings can influence nexus approaches for redressing EWF security as well as influence the success of policies. There is limited guidance for better policy-making to redress EWF security. Developing an institutional perspective can provide a more complete understanding of the EWF nexus as well as provide insights to inform improvements in the approach to governing EWF, addressing concerns about the need to alter or develop new approaches.

The institutional perspective developed in this research draws from institutional theory to analyse institutions which are broadly defined as humanly devised constraints (North 1990) such as rules, norms and customs that play a role in shaping social and economic behaviour at various scales. Institutions are both formal or informal or according to Cleaver (2002), bureaucratic or socially embedded. Formal or bureaucratic institutions include the constitution, legislation, regulation and other formally written rules while informal or socially embedded institutions include those related to social norms, moral values, conventions (Mantzavinos 2001), otherwise non-written rules such as customs, traditions or religious beliefs that shape the behaviour of individual or community.

In the context of EWF, institutions are represented by both formal and informal constraints associated with governing EWF, to meet socio-economic objectives and most importantly to ensure EWF security. Together, these constraints comprise the institutional settings for EWF. In this research, institutional settings refer to the network of institutions comprising numerous components. These institutions include reflecting informal aspects, the overarching development philosophy and reflecting formal aspects, government and its formal role in EWF matters, policy and legislative frameworks, organisations (individual actors and groups) and their role in implementing policy, as well as pricing and other sector-specific constraints (processes and arrangements). These capture the decision-making and policy-making structures for EWF matters. Such settings play a role in supporting the achievement of EWF objectives.

In developing an institutional perspective on the EWF nexus, one of the objectives is to develop a framework to examine the institutional settings for EWF. In this research, the proposed framework is based on Williamson's *Level of Institutional Analysis* (2000). The analysis is undertaken at country level because it provides a suitable scope to analyse how a country governs

its EWF resources, with equal emphasis on each sector.[1] EWF security is an area of national concern where EWF policies interact at both the national level and state levels.

1.1.4 Energy, water and food in the context of Australia

Increasing pressure on EWF resources is being felt in a number of countries, both developing and developed. The analysis of the EWF nexus at a country level, as previously mentioned, is useful in order to capture how EWF are governed.

Australia, despite its developed country status, also faces emerging security concerns. Appropriate policies and implementation strategies to redress EWF security challenges and to prevent the worsening of EWF security are becoming increasingly needed.

EWF security concerns are numerous and include: rising prices particularly for energy and water, the reliability of energy markets and the current energy system that is reliant on non-renewable resources, rising energy import dependency on oil, addressing climate change, the nature of water scarcity and tendency for drought in arid areas with implications for energy and food security and vice versa, land use competition between the energy sector for unconventional energy resource development (natural gas) and the agricultural sector to meet growing targets and maintaining the economic performance of EWF sectors to ensure the provision of EWF goods and services. These have become risks to EWF security in Australia. The EWF security concerns faced by the country involve both long-term struggles (e.g. water management) as well as recently emerging issues.

While water security has been an issue for a number of years, considering Australia's arid geography and susceptibility to water-related disasters such as droughts and floods, attention must also be placed on the future of energy security and food security in the country. This is because although Australia is recognised as both an energy and food producer and exporter, security challenges confronting EWF are emerging.

Australia is selected as a case study, firstly because the country faces emerging EWF security challenges and secondly, there has been no known study of this kind that has been undertaken in the Australian context.

[1] Importance of equal emphasis on each sector is due to a sector-bias towards the water sector in the EWF nexus literature. This is particularly pointed out in Smajgl, Ward & Pluschke (2016).

Overview of the Australian economy

The Commonwealth of Australia is a federal democracy comprising six states: New South Wales (NSW), Victoria, South Australia (SA), Tasmania, Queensland, Western Australia (WA), and two territories: the Northern Territory (NT) and the Australian Capital Territory (ACT).

Australia has a population of approximately 24.9 million people and has grown at a rate of approximately 1.7% per year over the last ten years attributed to both natural increase and net overseas migration (Australian Bureau of Statistics [ABS] 2018a). By 2055, Australia's population is projected to reach 39.7 million (Australian Government 2015). Australia's population is mostly urbanized with 80% living in major cities (Department of Infrastructure and Regional Development [DIRD] 2015, p. 14) and as a result of sustained low fertility and increased life expectancy, the population is an ageing one (ABS 2016).

Australia is a developed and high-income OECD country, ranking 13th in Gross Domestic Product (GDP)[2] in 2017 (World Bank 2017a) and 21st in Gross National Income per Capita[3] (World Bank 2017b). Over the last 27 years, Australia has experienced uninterrupted economic growth (Department of Foreign Affairs and Trade 2018). In 2018, GDP was $AUD 1.8 trillion. Since 1960, GDP has risen on average per year by 3.4% and over the last ten years 2.6% on average per year. With such rates, economic growth has been faster than population growth. In 2018, GDP per capita was $AUD 73 258 growing at 1.9% on average per year since 1960 and 0.9% on average per year over the last ten years (ABS 2018b). Table 1.1 summarises key economic statistics.

Australia is a 'highly skilled, knowledge-based and service-based economy' (Office of the Chief Economist 2014). Services account for almost 79%, mining 2%, manufacturing 7% and agriculture 3% (Office of the Chief Economist 2016). Services have continued to make a greater contribution to economic growth.

[2] Gross Domestic Product ranked in millions of US dollars

[3] Purchasing power parity (international dollars)

Table 1.1: Key statistics

	2018	% average annual growth (since 1960)	% average annual growth (since 2008)
Population [a]	24.9 million	1.5%	1.7%
Gross Domestic Product (GDP) [b]	$1.8 trillion (AUS)	3.4%	2.6%
GDP per capita	$73 258	1.9%	0.9%
			Average (since 2008)
Unemployment Rate [c]	5.1%		5.7%

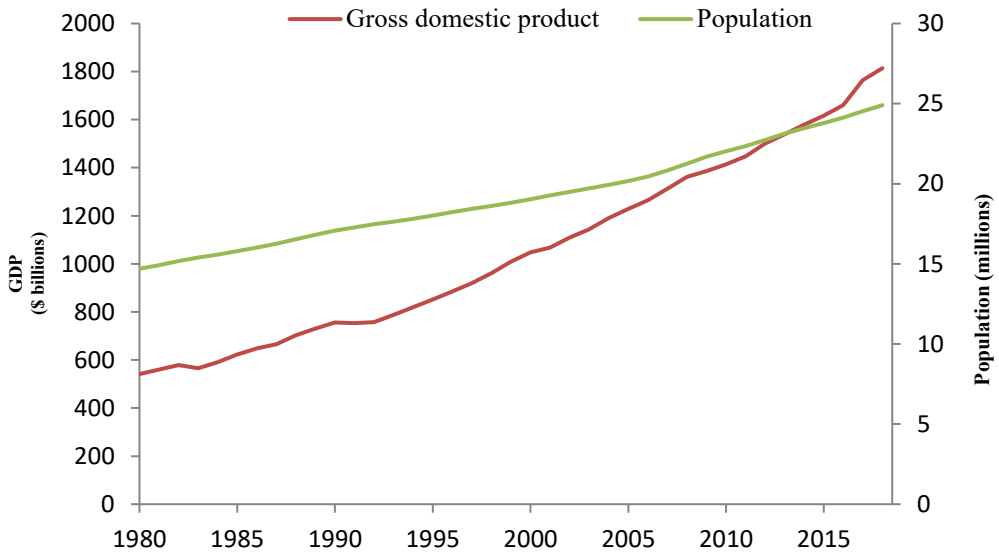
Source: Australian Bureau of Statistics (ABS)

[a] Calculated from Table 1. Population Change, Summary – Australia ('000'), cat. 3101.0 Australian Demographic Statistics

[b] Calculated from chain volume measures Table 34. Key Aggregates and analytical series, Annual, cat. 5606.0 Australian National Accounts: National Accounts: National Income, Expenditure and Product

[c] Calculated from Table 1. Labour force status by Sex, Australia cat. 6202.0 Labour Force, Australia

Figure 1.1: Economic and population growth



Source: Australian Bureau of Statistics (ABS), cat. 3101.0 Australian Demographic Statistics, cat. 5606.0 Australian National Accounts: National Accounts: National Income, Expenditure and Product

Energy, water and food sectors

Australia is both a net exporter in energy and food. EWF sectors play an important role in the economy. EWF sectors together contributed approximately $217.3 billion to the economy in 2016-2017, equating to 12% of GDP. Together, these sectors accounted for 1.4 million of the total employed persons in Australia, 11% of all jobs in the economy (ABS 2018e). Table 1.2 shows the economic contribution of EWF sectors.

Table 1.2: Economic contribution, growth and employment in EWF sectors 2016-2017

Sector	Gross Value Added ($m)	Contribution to the sector (%)	Contribution to GDP (%)	Employment (000)	Employment (share of total %)
Energy Sector	89 987			147	
Coal Mining	30 054	33%	1.7%	35	24%
Oil and Gas Extraction	24 059	27%	1.4%	17	12%
Petroleum and Coal Manufacturing	1 959	2%	0.1%	5	3%
Electricity Supply	28 774	32%	1.6%	44	30%
Gas Supply	2 305	3%	0.1%	3	2%
Fuel Retailing	2 836	3%	0.2%	43	29%
Water Sector	12 998		0.7%	27	
Water supply, sewerage and drainage services	12998	100%	0.7%	27	100%
Food Sector	114 315		6.5%	1201	
Agriculture and fishery	33 425	29%	1.9%	472	39%
Food, beverage and tobacco manufacturing	25 042	22%	1.4%	245	20%
Food retailing	23 096	20%	1.3%	43	4%
Food and beverage Services	32 752	29%	1.9%	441	37%
Total Energy, Water and Food Sectors	217 300	12%	12.3%	1375	11%
Total Economy (GDP)	**1764512** [(a)]			**12666** [(b)]	

Source: Australian Bureau of Statistics (ABS) 8155.0 Australian Industry, 2016-17

[(a)] 5206.0 Australian National Accounts: National Income, Expenditure and Product Table 37. Industry Gross Value Added, Chain volume measures, Annual (GDP in chain volume measures)

[(b)] 6202.0 Labour Force, Australia Table 1. Labour force status by Sex, Australia

Energy, water and food security challenges

The growth of the population and economy is likely to further place pressure on resources with increased EWF demands and implications for EWF security. Consumption of EWF is expected to rise.

Energy consumption over the past ten years has risen steadily at 0.8% average annual growth, rising 1.1% in 2016-17. Over the last ten years, growth has been the greatest in the consumption of renewables, with 3.2% average annual growth and 5.3% in 2016-17. Gas consumption has grown by 2.9% on average per year over the last ten years. Energy consumption varies across the states. In 2016-17, the greatest increase in energy use was in WA and Queensland, which experienced growth of 5% and 4% respectively, while energy use in Victoria and SA fell, 2% and

9% (as a result of the closure of coal-fired electricity generation capacity) (Department of the Environment and Energy [DEE] 2018b).

Energy consumption is expected to grow. According to the Australian Energy Market Operator (AEMO) (2017) grid-supplied electricity over the next 20 years is forecasted to remain relatively flat as a result of energy efficiency and self-generation, however, under strong conditions, consumption may rise by 15% or higher. Gas consumption, however, over the next 20 years, while uncertain, is forecasted to triple, particularly as Australia becomes the world's largest LNG exporter (AEMO 2016).

In 2010, the Water Services Association Australia predicted that by 2026, major urban centres would require an additional demand of over 600 billion litres annually and by 2056, a demand of over 1000 billion litres (Water Services Association of Australia 2010). According to the ABS, total water consumption data shows that after peaking in 2012-13, water consumption fell by 22%, from 19 756GL to 16 132GL in 2015-16. While the decline appears to be driven by industry consumption use, water consumption use by households, however, rose in 2010-11 at 2% on average per year (ABS 2017). According to the National Performance Report of urban water utilities by Bureau of Meteorology (BOM), more recent statistics show that between 2015-16 and 2016-17, there was an average 3% increase in the total volume of water sourced (Bureau of Meteorology [BOM] 2018, p. 16). There is a consistent rising trend in water use by households. From 2016-17, agricultural water use also increased. The total agricultural area watered increased by 4% while the volume of water used for irrigation also rose by 9% over the year (ABS 2018f).

Food consumption levels have also increased over time. Since 1970s, wheat consumption has increased by 55% per capita, peaking in 2006. Growth in wheat consumption from 2010-13 averaged 12.6%. Seafood consumption has also increased with Australians consuming 16kg of seafood per person in 2014, although Australians consumed more meat at 111kg per year. Furthermore, the demand for dairy products has increased as of 2011 (Di Nunzio 2014).

Household food consumption from 1988-89 to 2016-17 has risen 2.4% on average per year. Drivers of growth include population growth, changes in preferences, lower real food prices and income growth (Hogan 2018, p. 9). In the same period, household food consumption expenditure rose on average by 2.3% per year (Hogan 2018, p. 8). According to Hogan (2018, p. 8), by 2049-50, household food consumption expenditure is predicted to increase from $92 billion in 2016-17 to $165 billion, rising on average 1.8% per year. Total food consumption is expected to increase with population growth. According Linehan et al. (2012, p. 6), the real value of world agrifood demand in 2050 is projected to be 77% higher than in 2007, representing an annual average increase of 1.3% over the projection period.

Energy, water and food prices

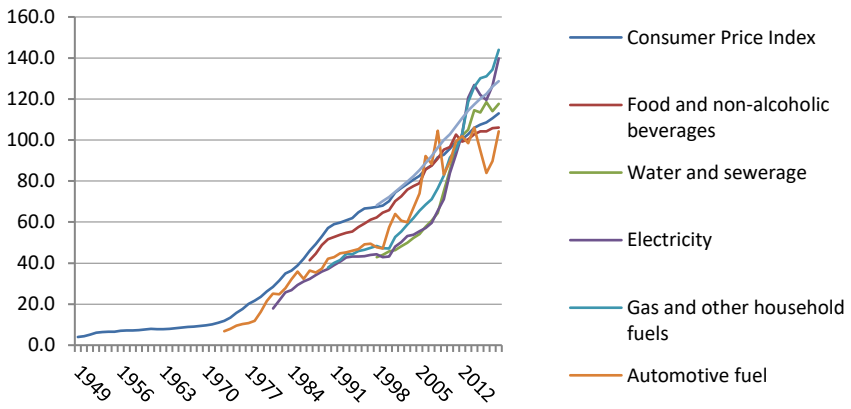
Along with the increased consumption of EWF, prices have also risen. Table 1.3 shows that of the EWF consumer price index (CPI) groups, utilities, water and sewerage, electricity and gas have risen faster than consumer and wage price indexes (WPI). Figure 1.2 shows that in the last few years, electricity and gas prices have outstripped both CPI and WPI. Over the last ten years, the WPI has grown on average per year by 2.8%, growing 32% from 2008, while CPI has grown at a slower rate at 2% on average for the ten years and 22% since 2008 (ABS 2018c; 2018d). Rising EWF prices, particularly energy contribute to EWF security concerns.

Table 1.3: Consumer Price Index growth rates 2018

CPI groups	% growth since 2008	% growth (average annual)
CPI	22%	2%
Food and non-alcoholic beverages	16%	1.5%
Utilities	93%	6.8%
Water and Sewerage	68%	5.3%
Electricity	109%	7.6%
Gas and other household fuels	83%	6.2%
Automotive fuel	-1%	-0.1%
WPI	32%	2.8%

Source: Australian Bureau of Statistics (ABS) calculated from cat. 6401.0 Consumer Price Index 2018 and cat. 6345.0 Wage Price Index 2018

Figure 1.2: Consumer Price Index trends



Source: Australian Bureau of Statistics (ABS) calculated from cat. 6401.0 Consumer Price Index 2018 and cat. 6345,0 Wage Price Index 2018

Energy security

The concept of energy security in the context of Australia has evolved and is dynamic. Once synonymous with oil security during the 1970s, the term has now come to encompass a broader range of energy-related areas. According to the Australian government, energy security is defined as the adequate, reliable and competitive supply of energy across the electricity, gas and liquid fuel sectors (DEE 2018d). Adequacy refers to the provision of sufficient energy to support economic and social activity; reliability refers to the provision of energy with minimal disruptions to supply and competitive refers to the provision of energy at an affordable price.

Australia's energy security situation is complex and dynamic. Despite being a net energy exporter, producing almost three times more than energy consumed[4] the country faces a range of energy security challenges. These include energy supply shortages and supply interruptions, the need to transition from a largely fossil-fuel dependent country towards a low carbon economy, rising energy prices and also rising import dependence, particularly for oil. These challenges are interrelated.

Rising energy prices have been attributed to various reasons including shortages in both the supply of gas and electricity. Gas shortages in recent years have been the result of gas exports that have limited the domestic gas supply to meet more lucrative international demands. Despite Australia being one of the largest producers of gas, most of Australia's supply is exported. Gas has become an important source of energy and is seen as a transition fuel to renewables, particularly as the country lessens its dependence on coal. Gas shortages have wide impacts, limiting electricity generation and impacting industries and also constraining progress towards renewables. Meeting both domestic and international gas demands puts pressure on current resources. To expand supply, the lifting of moratoria on natural gas exploration and production has been encouraged (Daley et al. 2018), with implications for unconventional gas production (a controversial source of energy).

A number of factors have also led to rising electricity prices and according to the Australian Competition and Consumer Commission (ACCC), these include excess spending by network owners (with reasons including to meet high reliability standards) and inadequate regulation to constrain spending; cost of solar power schemes; gas shortages for gas-powered generation (particularly in light of the closure of large coal-fired plants) and inadequate pricing structures (Australian Competition and Consumer Commission [ACCC] 2018). According to the ACCC, residential consumers faced a real increase of 35% in their bill and a price increase of around 56%

[4] Energy exports from 2016-2017 rose by 4% and over the last ten years exports have grown by 5.6% on average per year. Energy production was three times greater than energy consumption (DEE 2018b).

in real terms from 2007-08 to 2017-18 (ACCC 2018, p. 5). Increases in prices have also led to energy customers falling into debt and entering hardship programs. According to the Australian Energy Regulator (AER), with a decline in affordability of electricity, the proportion of residential customers with electricity debt increased in most jurisdictions in 2016-17 and the proportion of these customers receiving assistance to repay their debt through hardship programs has increased (Australian Energy Regulator [AER] 2017a, p. 27). Between 2014 and 2015, the total number of customers on hardship programs increased in all jurisdictions rising by an average of 26% (AER 2015, p. 140).

Shortages of capacity contributing to higher prices have also been a result of the closure of coal-fired power stations and a lack of investment in new capacity. Lack of investment has been attributed to uncertainty with climate policy as well as a lack of incentives for investment. These have continued to put pressure on the power supply.

Transitioning towards a low carbon economy is also a challenge for the country, as it lessens its dependence on non-renewables, which it also relies on for exports. Hence, there are important economic implications associated with reducing Australia's reliance on non-renewable energy. Vested interests in the coal sector have played a large role in slowing down the transition.

In 2016 and 2017, the state of South Australia, powered mostly by renewable sources, experienced serious blackouts leading to concerns about the reliability of the current energy system, the National Electricity Market, and its ability to adapt to the use of renewable energy and emerging new energy technologies necessary for Australia's transition.

Although Australia is an energy producer, it still must import energy to meet energy needs, particularly oil and liquid fuel. The largest growth in imports was in refined products and crude oil, which has grown at 8% over the last ten years and 4% since 2016-17. Oil, including crude oil, liquefied petroleum gas (LPG) and refined products, accounted for the largest share of energy consumption, at 38% in 2016-17 (Department of the Environment and Energy 2018b, p. 7). Oil consumption increased by 2.1% in 2016-17 with an average annual growth of 1.7% over the last ten years. The growth in consumption of oil and the need for imports, signal security challenges.

Australia does not have safe oil stocks even though it is required to comply with the International Energy Agency (IEA) requirements, this being that all members maintain oil stocks equivalent to at least 90 days of the previous year's daily net oil imports. Since 2012, the country has been non-compliant. Australia has an aggregated fuel reserve of roughly 48 days, including about 22 days' supply of crude oil, 59 days of LPG, 20 days of petrol, 19 days of aviation fuel, and 21 days of diesel (Hepburn 2018).

Water security

A definition of water security is provided by the Australian Water Association (AWA), a national peak water organisation, which defines water security as 'the certainty the Australian community can have that its water needs will be met into the future on an economically, socially and environmentally sustainable basis'. Accordingly, these water needs include safe and affordable drinking water, water to support industry and agriculture, water management to create livable communities and water to protect the environment (Australian Water Association [AWA] 2016, p. 4). There is no official water security definition provided by the government. Similar to the concept of 'energy security', water security in Australia is multidimensional with social, economic, environmental and also spiritual and cultural dimensions.

Considered as one of the driest inhabited continents, water security has long been a significant issue in Australia. Water security challenges have stemmed from both the impacts of a highly variable climate and the human management of water. They are also interrelated.

The country's climate produces both severe droughts and floods and over the years, their worsening has been increasingly attributed to the impacts of climate change (Steffen et al. 2018). Droughts and floods have a wide range of impacts on society, the economy and the environment. For example, droughts can significantly reduce agricultural and industrial production as well as impact soil conditions. A drought year can reduce national wheat production by more than 60% or more when compared with a year with good rainfall (Prime Minister's Science Engineering and Innovation Council [PMSEIC] 2010, p. 11). Recent droughts in the eastern states in 2018 have also had social impacts on rural communities, contributing to hardship and loss of livelihoods as well as environmental impacts, affecting local wildlife. Floods pose health risks to impacted communities.

The historical mismanagement of water and the environment has also had long-term impacts on water resources, which decades of reforms have sought to address. Water reforms continue to address water governance and management with greater consideration of environmental impacts and the needs of the environment. The management of the Murray-Darling Basin (MDB), however, has received criticism for failure to implement improved water practices and enforce regulations, with conflicts between upstream and downstream users and between states. Further work is needed to better manage rural water as well as urban water.

Improvements in infrastructure have however fostered water supply security in enabling a diversification of water sources, reducing the dependence on surface water with the introduction of desalination and recycled water (National Water Commission [NWC] 2014, p. 3) although unplanned interruptions to water supply continue to exist (Bureau of Meteorology 2017, 2018). The provision of safe, secure, efficient and sustainable water and waste services, according to the

AWA, continues to remain primary drivers for urban water reform for urban water security (AWA 2017, p. 8).

As an important input, water shortages create competition between all users, households and industry, leading to rising prices and at times water restrictions. Since 2005-06, the typical residential water bill has risen, with the largest increase of 8% occurring in 2012-13 due to an increase in water consumption and price increases in many utilities (BOM 2016; BOM 2017; NWC 2014) Only in 2016-2017 have was bills plateaued (BOM 2018).

Rising water demands and climate change, seen to intensify droughts (along with the El Niño phenomenon) and floods which can have a worsening impact, have continued to put pressure on Australia's water security, creating challenges in the management of water shortages and ensuring water quality. As a result, water security in Australia will continue to be a significant issue, even with improvements in infrastructure, changes in behaviour and governance. One of the reasons is because even in times of favourable water conditions, these can be reversed by external factors, putting greater stress on water resources, creating water security challenges and testing society's resilience.

Food security

Food security, according to a report by Australian Bureau of Agricultural and Resource Economics (ABARES), is the 'adequate and reliable provision of food that is safe, nutritious and affordable' (Hogan 2017, p. 38). This definition follows from the UN's Food and Agriculture Organisation (FAO) definition that food security 'exists when all people at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'. Also mentioned was 'nutrition security' referring to 'when secure access to an appropriately nutritious diet is coupled with a sanitary environment, adequate health services and care, to ensure a healthy and active life for all household members'. Nutrition security considers aspects of adequate caring practices, health and hygiene in addition to dietary adequacy (Hogan, 2017 cites FAO, 2012, p. 52-57). The definition of food security furthermore is based on five key dimensions. These include: availability - sufficient supply of food for all people at all times; accessibility - physical and economic access to food at all times (also describes equality of access to food; acceptability - access to culturally acceptable food which is produced and obtained in ways that do not compromise people's dignity, self-respect or human rights; adequacy - access to food that is nutritious, safe and produced in environmentally sustainable ways and; stability - reliability of food supply (PMSEIC 2010, p. 9).

As a large producer and net exporter of food, Australia is generally considered as food secure. In 2010, it was estimated that Australia produces enough food to feed 60 million (Department of Agriculture [DA] 2013, p. 23). Although prices have risen, as previously detailed, food has

remained affordable with the country ranking 6th in food affordability in the world in 2018, according to the Global Food Security Index (The Economist Intelligence Unit 2018)). On the same index, Australia ranked 11th in availability of food and 4th in quality and safety of food.

While food appears to be abundant and secure, food security remains an issue. Food security challenges exist for disadvantaged groups such as the unemployed, single-parent households, low-income earners, rental households, young people as well as indigenous groups and socially isolated groups (Rosier 2011). According to the Foodbank (2017), a non-profit organisation, based on data from two surveys, 3.6 million Australians (15%) had experienced food insecurity at least once in the last 12 months, with three in five of these individuals experiencing food insecurity at least once a month. Furthermore, two in five food insecure Australians have not paid bills in order to have enough money to buy food.

In addition to the lack of economic access to food, the population also suffers from food-related diseases which is indicative of a problem with nutrition security. In the latest National Health Survey (ABS 2015) in 2014-15, 63.4% of Australian adults were overweight or obese (11.2 million people). This is similar to the statistic in 2011-12 (62.8%) and represents an increase since 1995 (56.3%). Around one in four (27.4%) children aged 5-17 years were overweight or obese, similar to 2011-12 (25.7%). In 2014-15, the number of Australians reporting high cholesterol increased from 6.8% in 2011-12 to 7.1%.

As Australia, in general, currently enjoys food security, population growth, as well as climate change constraints, are expected to give rise to further food security challenges. For example, according to Heyhoe et al. (2007), by 2030, climate change could reduce the production of wheat by more than 13%.[5] Furthermore, food security challenges will be exacerbated by natural disasters, slowing productivity, leading to land degradation and reducing soil fertility, particularly as Australian soils are ancient and nutrient poor, suffering from erosion and acidification (PMSEIC 2010), relying on production inputs such as fertilisers. Water and energy availability, competition for land, urbanisation and the impacts of biofuels on food production are also seen to limit food production. In addition to placing stress on available food resources, population growth could lead to greater imports.

[5] The figure is based on a low rainfall scenario that is predicted to greatly affect Western Australia compared with New South Wales (Heyhoe et al. 2007, p. 174).

Energy, water and food security linkages

The EWF security issues described above are inter-relate. Energy and water are important inputs for the production and supply of EWF. Physical shortages and changes in prices in one or two resources will impact on the supply and price of the other. For example, rising gas prices are seen to impact various industries, particularly manufacturers reliant on gas including food processors (Morgan 2016). As mentioned, droughts have a serious effect by reducing agricultural production, which could potentially lead to food shortages. Climate change will also pose various risks to each sector. Table 1.4 shows energy and water consumption by EWF sectors. Table 1.5 shows energy and water intensity and productivity by sector. Both tables indicate physical and economic linkages.[6]

Table 1.4: Energy and water consumption of energy, water and food sectors 2015-2016

Sectors	2015-16	% share of total consumption	Growth since 2008-09 (%)	Growth since 2008-09 (% average annual)
Energy Consumption (PJ)				
Energy	2 244	37%	-2%	0%
Water	16	0.3%	18%	2%
Food	271	4%	27%	3%
Total EWF sectors	2531	42%	0.2%	0.0%
Water Consumption (ML)				
Energy	525 751	3%	-1%	0%
Water	2 013 810	12%	31%	4%
Food	9 880 811	61%	30%	4%
Total EWF sectors	12420372	77%	19%	3%

Source: Energy Consumption Data sourced from the Department of Environment and Energy 'Energy Statistics 2018, Table F. Water Consumption Data sourced from the Australian Bureau of Statistics Water Account 2015-216.

Note: Although energy consumption data for 2016-17 is available, data for 2015-16 is used to enable comparison with most recent water consumption data. Earliest water data is from 2008-09 which explains comparison from this year. Energy sector includes coal mining, oil and gas extraction, petroleum and coal product manufacturing and electricity and gas supply. Water sector includes Water, sewerage and drainage sector while the Food sector includes Agriculture, forestry and fisheries (Forestry is not separated) and Food, beverage and tobacco manufacturing.

Table 1.4 shows that EWF sectors account for a sizeable proportion of energy consumption (42%) and water consumption (77%) and agriculture is the largest user of water. The food sector

[6] Detailed versions of these tables are provided in Appendix A.

consumes the most water and the most energy (excluding the energy sector). While the energy sector's consumption of energy and water has declined over the years, the water and food sectors' consumption of energy and water has increased over the years. Oil and gas extraction has seen the largest growth in the consumption of energy, increasing at 8% on average over the years from 2008-09 to 2015-16. Growth in energy consumption has been seen in food, beverage and tobacco manufacturing which has grown at 34% over the period and 4% each year on average. The table indicates physical linkages between EWF.

Table 1.5 shows that the food sector is the most energy intensive (excluding energy) and water intensive, while the water sector is most energy productive. The food sector is the least water productive while the energy sector is the most water productive.

The linkages between EWF are complex and apparent. Water is a necessary input for food production to a large extent and to a smaller extent, energy production, aside from hydroelectricity. As mentioned, water shortages can lead to a decline in agricultural production and potentially food insecurity. While water infrastructure can play a role in delivering water savings and water efficiencies, water infrastructure is also energy-intensive which means that ensuring water and thus food security may become more costly as a result of potential rising energy prices from energy scarcity. Both water and food are vulnerable to higher energy prices. Limited options for energy resources from a reliance on fossil fuels means that the more energy intensive water and food sectors become, the more they will contribute to pollution and emissions, further contributing to climate change.

Table 1.5: Energy and water intensity and productivity 2015-2016

	Intensity unit/$	**Productivity $/unit**
Energy	GL/$m	$m/PJ
Energy sector	31 837	31.4
Water sector	1 214	823.9
Food sector	4 802	208.3
Water	ML/$m	$000/ML
Energy sector	7.4	134.7
Water sector	152.8	6.5
Food sector	175.3	5.7

Source: Department of Environment and Energy, 2018 Australian Energy Statistics Table F Australian Energy Consumption, by state, by industry and fuel type and energy units, ABS Australian Industry 2016-17 cat. 8155.0, ABS Water Account 2015-16 cat. 4610.0. Note: Intensities and productivities are based on Industry Value Added figures.

The exploration of energy resources such as gas, however, may also cause competition for land that is both energy-rich and fertile, posing trade-offs between energy and food security. For example, the exploration and promotion of unconventional gas to support rising energy needs, however, may have potentially negative impacts on water, food and land resources. Similarly, allocating agricultural land for biofuels and non-food crops can also compromise food security.

There are numerous linkages between EWF and each pose certain trade-offs and there may also be synergies. For example, less water-intensive and renewable energies such as solar panels and wind to power water infrastructure may ease the pressure on other energy resources and water resources that are used to generate the power needed while creating water savings through water efficiencies.

Summary

Given the above discussion, Australia faces a range of current and emerging EWF security challenges that require effective policy measures to redress EWF security and their interconnected impacts. There are several specific security concerns.

Although Australia is a major exporter and producer of energy, the country still faces energy shortages particularly in gas as a result of export priorities. Increasing reliance on oil imports, becoming one of the most consumed fuels, means that the country is vulnerable to external risks. The reliance on non-renewable sources which comprise a large share of energy supply suggests further challenges for Australia to shift towards a low carbon economy and importantly to meet its international commitments to reduce carbon emissions. Not only does energy consumption contribute to emissions, it also leaves Australia reliant on resources that are becoming increasingly scarce. Gas and electricity prices have risen, and there is an increasing number of energy customers, who are experiencing difficulties in paying their bills, on hardship programs. The security of power supply and reliability remains a serious issue, particularly with measures to reduce emissions and adopt renewables to address the shortages in capacity from the closure of coal-fired power stations. Australia's current energy system, the National Electricity Market, has also become a concern regarding its ability to adapt and foster the use of renewable energies and new technologies.

Water security continues to be an issue for Australia, particularly as the country is arid and experiences droughts and floods and increasing rainfall and weather variability. Although water consumption has fallen, water prices have risen, particularly for households which are paying more for less water. Despite improvements in water supply security regarding the diversification of water sources such as recycled water and desalination, unplanned water interruptions continue

to be experienced by households. Ensuring access to water hence is also an issue. Intensive droughts will continue to impact communities.

Food security, however, has been less worrisome, although there are still groups of people who experience food insecurity such as the most disadvantaged groups. Future security issues for food stem from slowing productivity, land degradation and climate change, where the security of clean water as well as the security of fertile land will continue to be limiting factors on food production.

Ensuring EWF security in Australia is a task in which the Australian government plays an important role. To prevent the serious social, economic, political and environmental impacts of worsening security, there is a need for sound policy and overall appropriate institutional settings that, in particular, incorporate consideration of interlinkages between EWF in the governance of EWF.

Developing an institutional perspective on the EWF nexus in Australia may provide the necessary insights needed to understand how current institutional settings may evolve to more appropriately redress EWF security.

The primary research objective and specific objectives are detailed in the following section.

1.2 Research objectives

1.2.1 Primary objectives

The primary objective of this research is to develop an 'institutional perspective' on the energy, water and food (EWF) nexus in the context of Australia, to inform policy making to redress EWF security challenges.

Emphasis is on the need to enhance the capacity of policy-makers to incorporate greater consideration of the inter-sectoral linkages and interdependencies between EWF that pose trade-offs or synergies that may negatively or positively affect the achievement of EWF security objectives. Thus, focus is on understanding the degree to which institutional settings provide a framework for which EWF can be governed jointly to ensure positive outcomes.

1.2.2 Specific objectives

To achieve the primary objective, the specific objectives include:

Sub-Objective 1: To review current understanding about EWF nexus in the context of redressing EWF security challenges – to establish the centrality of institutions in providing such redress.

Sub-Objective 2: To develop an understanding of 'institutional theory' with a view to develop a framework to analyse the institutional dimensions of the EWF nexus.

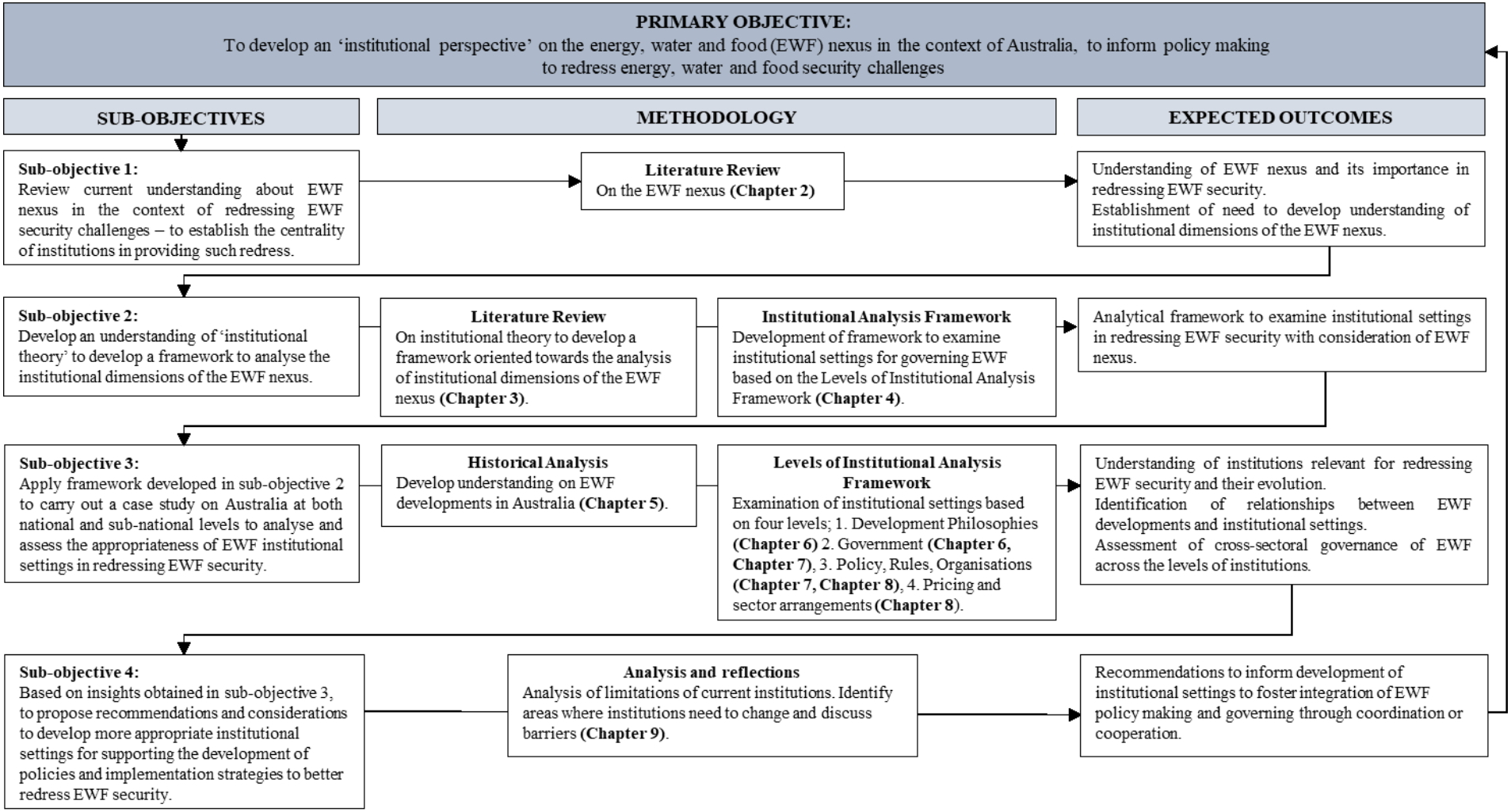
Sub-Objective 3: To apply the framework developed in sub-objective 2 to carry out a case study on Australia at both national and sub-national levels with a view to analyse and assess the appropriateness of EWF institutional settings in redressing EWF security.

Sub-Objective 4: Based on insights obtained in sub-objective 3, to propose a set of recommendations and considerations to develop more appropriate institutional settings for supporting the development of policies and implementation strategies to better redress EWF security.

1.3 Research framework and methodology

The research framework is detailed in Figure 1.3. The following section details how each sub-objective is achieved and what research methodologies are utilised.

Figure 1.3: Research Framework



Sub-objective 1

The first sub-objective is to review current understanding about EWF nexus in the context of redressing EWF security challenges – to establish the centrality of institutions in providing such redress.

Method

To complete this sub-objective, a literature review is undertaken on the EWF nexus. This is to develop an understanding of the emerging literature on the EWF nexus, looking at how the EWF nexus is defined and conceptualised, why the EWF nexus has become important particularly in the context of EWF security and how EWF nexus knowledge contributes to the knowledge needed to redress EWF security. In particular, the review identifies the extent to which institutional dimensions are captured in current literature.

Outcome

The outcome of this sub-objective is an understanding of firstly, the concept of the EWF nexus and how an understanding of the EWF nexus is necessary to redress EWF security. The lack of attention to the institutional dimensions of the EWF nexus is identified, supporting the need for research.

Sub-objective 2

To develop an understanding of 'institutional theory' with a view to develop a framework to analyse the institutional dimensions of the EWF nexus and hence, to develop an institutional perspective on the EWF nexus. Such understanding will furthermore demonstrate the importance of institutions.

Method

To complete this second sub-objective, a literature review on institutional theory and analysis is undertaken to understand the key concepts: – What are institutions? What do they do? How they emerge? How they change? This is needed to select and define 'institutions' appropriate for this research and to develop the overall analytical framework needed to meet the primary objective. The literature review will cover institutional analysis and its application, the importance of institutions in understanding and analysing a variety of issues (e.g., economic, political, social, environmental) including EWF security issues. An analytical framework will be developed to analyse the institutional dimensions of the EWF nexus.

Outcome

The main outcome of this sub-objective is the development of an analytical framework appropriate for the analysis of institutional settings in redressing EWF with consideration of EWF nexus.

Sub-objective 3

Apply the framework developed in sub-objective 2 to carry out a case study on Australia at both national and sub-national levels with a view to analyse and assess the appropriateness of the EWF institutional settings in redressing EWF security.

Method

The application of the framework is to develop an in-depth case study on Australia at a national and state level, across a time frame from the country's colonial developments to the present. A historical analysis is undertaken to examine the evolution of EWF governance at the federal and state level, comparing the experiences of the different states. It considers state differences in terms of government, political environment, economy and the environment shaping different EWF security situations. EWF sector developments are examined in line with the broader economic, social and environmental developments from the late 1700s to the present.

The analysis in particular considers higher-level factors, firstly involving ideological shifts that have influenced certain developmental philosophies and secondly, how these have influenced the changing role of the government, both in general and in the context of EWF. This is captured in the level of institutional analysis.

Literature is reviewed to develop historical profiles of each state and territory, and of the nation to trace economic, social and environmental developments and EWF sector developments. Literature is reviewed to understand how EWF security has been defined in the context of Australia over time and to understand the evolving EWF security situation, shaping the overall approach for dealing with EWF issues in the country. An analysis is carried out for each jurisdiction to enable comparison between them.

The developed framework enables the analysis of institutions and is broadly based on North (1990) who defines institutions as 'humanly devised constraints' including both formal and informal rules and on Williamson's (2000) *Levels of Institutional Analysis Framework*, which develops a hierarchy to analyse the influence of higher-level institutions on lower-levels institutions.

Institutions are categorised into four main levels and are as follows:

1. Level 1 – Informal Institutions - Developmental philosophies and ideologies. These are associated with certain beliefs regarding development and progress, for example, Keynesianism and Neoliberalism.
2. Level 2 – Formal Institutions – Role of government (intergovernmental relations, decentralisation vs centralisation, public and private involvement, EWF responsibilities); political environment (government in power); bureaucratic structure (portfolio representation and ministerial responsibilities).
3. Level 3 – Formal Institutions – Planning and development institutions associated with EWF policy, rules (legislation and regulation) and organisations (the administrative arrangements that comprise agencies and bodies that play a role in the EWF sectors)
4. Level 4 – Formal Institutions – Sector-specific pricing processes and other sector arrangements.

The analysis covers a number of areas, including government involvement and responsibilities in relation to EWF matters, political environment, bureaucratic structure, the evolution of EWF policies, legislation and organisations as well as other processes and arrangements that exist to deal with EWF matters. The analysis also considers the broader developmental philosophies and ideological shifts that influence the above. Together all have an impact on EWF security.

An assessment of the adequacy of institutions in dealing with EWF security will be based on the extent to which institutions reflect and enable the implementation of a siloed or integrated approach to EWF, that is, whether considerations of other sectors are evident. This will also have implications for the adequacy of both higher-level institutions and lower-level institutions.

Outcome

The main outcomes of this objective include an understanding of past and current institutional settings for the governance of EWF which are relevant for redressing EWF security in the context of Australia, at the national and state level. It includes an assessment of the adequacy of the institutions, as shaped by history, for redressing EWF security based on the extent to which an integrated EWF nexus approach is reflected. It also includes an identification of key issues, limitations of current institutions and barriers to overcome limitations.

Sub-objective 4

Based on insights obtained in sub-objective 3, to propose a set of recommendations and considerations to develop more appropriate institutional settings for supporting the development of policies and implementation strategies to better redress EWF security.

Outcome

To complete the final objective, based on the previous insights and observations from the application of the framework, a hierarchy of recommendations will be proposed to overcome the weaknesses of current institutional settings and to enable EWF to be jointly governed, that is to facilitate a *nexus*-based approach to governing EWF.

The research is cross-disciplinary, policy focused and empirical and draws recourse to economics, political science, public administration and philosophy. These objectives have been set to meet the primary objective of developing an institutional perspective on the EWF nexus in the context of Australia to inform policy making to redress EWF security challenges.

Insights are gained on the experience of the different jurisdictions in Australia, at the federal and state level. These insights are defined in the scope of the research discussed in the following section.

1.4 Scope of research

1.4.1 Spatial and geographic scope

The geographic scope of this research is Australia. The analytical framework applied examines institutions at both the national and state level, to develop case studies of the Commonwealth and each state and territory including discussion of New South Wales, Victoria, Queensland, South Australia, Tasmania, Western Australia, Northern Territory and Australian Capital Territory.

The need to analyse both Commonwealth and state levels is due to the states' primary powers, particularly over energy and water. Hence, the analysis of EWF institutions would be limited without analysis at the state level. Unlike other countries, the small number of states and territories (eight in total) make such analysis possible compared with other countries such as the United States, China or India, for which an in-depth analysis would be difficult given the large number of state and provincial jurisdictions. The analysis includes a comparison between levels of government (federal and state) and between states considering cross-boundary, regional and local issues, and political and historical differences.

Although analysis at the level of local government would be beneficial as local governments indeed have EWF-related responsibilities, in-depth analysis at this level is out of the scope of the research. This is because of the number of local governments in Australia as there are more than 500 local councils across the country (Australian Local Government Association 2018). Also local levels are essentially responsible for implementation than policy. Discussion of local governments is kept at a broad level, rather than providing an analysis of specific local

governments in each state and territory. Another reason for limiting the scope is because of the temporal scale of this research, discussed in the following section.

1.4.2 Temporal scope

These case studies account for differences between scales and potential tensions between levels and between states and across five main time periods of Australia's history. These time periods are:

1. **Early Settlement and Colonial Development (late 1700s to 1900).** The first period covers early settlement in Australia from the late 1700s to the 1900, looking at the colonial development, with an emphasis from the mid-1850s and the establishment of self-government in the states. This also covers early developments in EWF sectors such as technological advancements in energy supply such as electricity and developments in irrigation systems and the immediate importance of developing agriculture.
2. **Federation, World War I and the Great Depression (1901 to 1938).** The second period starts with Australia's Federation from 1901, when the states agreed to become a federation, forming a unified country and giving rise to a federalist system with a federal government. This period involves key events that shaped the role of government such as World War I and the Great Depression.
3. **World War II and the Post-war Economy (1939 to 1969).** The third period begins with World War II and looks at the post-war economy with the adoption of Keynesianism and the growing role of the government in all economic matters (relevant to EWF).
4. **Economic Reform, Globalisation and Environmental Awareness (1970 to 1999).** The fourth period extends from the 1970s to the late 1990s, covering a transitionary period of economic reform from a heavily government-involved economy to a market-based neoliberal economy, contrasting significantly from previous periods. It is also a period of heightened environmental awareness.
5. **Post-Reform Economy and Contemporary Challenges (2000 to the present).** The fifth period looks at the turn of the century where the country enters a post-reform period. Continued efforts are to enhance and ensure the growth and development of the neoliberal economy. This period also examines the contemporary challenges related to emerging EWF security challenges.

Table 1.6 details the temporal and spatial scope of analysis for the relevant objectives.

Table 1.6: Scope of analysis for relevant objectives

Specific Objectives	Research Methods	Temporal	Spatial
1	Literature Review	Current EWF nexus literature	Global Regional and sub-regional Country
2	Literature Review	Historical and current literature on institutional theory, public policy and public administration	Non-specific
3	Institutional Analysis Historical Analysis	Australia's history from the late 1700s since colonial development, from self-government of the states to the present: Period 1: late 1700s to 1900 Period 2: 1901 to 1938 Period 3: 1939-1969 Period 4: 1970-1999 Period 5: 2000-Present	National State and territory
4	Not applicable – sub-objective 4 concerns development of recommendations	Current	National State and Territory

1.5 Data considerations

The methodological framework developed for this research is cross-disciplinary. Data requirements will be diverse.

The first objective to develop an understanding of the EWF nexus requires an extensive review of literature that includes mostly journal articles, published papers ranging from international and national organisations and books. A similar literature review is carried out for the second objective to develop an understanding of institutional theory to develop the analytical framework.

The third objective, to apply the framework for analysing institutional settings for EWF in Australia, requires a vast collection of historical data from, in addition to books and journal articles,

- Commonwealth and State Year Books provided by the Australian Bureau of Statistics
- Government publications – policy statements, white and green papers, discussion papers, reports, policy reviews, government department annual reports, Commission papers,
- Legal documents detailing legislation and regulation

- Parliamentary information - parliamentary Hansard, parliamentary handbooks, ministry lists
- Australian Politics and Elections Database (The University of Western Australia)
- Government Gazettes (Administrative Arrangements, Machinery of Government Changes)
- State Archives (New South Wales, Victoria, Queensland, Tasmania, South Australia, Western Australian, Northern Territory)
- Statistics from the Australian Bureau of Statistics and other government bodies, government departments and government organisations such as ABARES
- Media – news articles, media releases

The fourth objective does not rely on new data but considers potential solutions applicable to the public service to facilitate the collaboration and coordination of EWF policy.

Given the temporal scope, obtaining complete data is not possible. For instance, only recent policy documents are available from the last few decades.

Table 1.7 lists data considerations for this research.

Table 1.7: Data considerations for specific objectives

Specific Objectives	Data Requirements	Data Sources	Data Available	Data Gaps	Strategies to overcome data gap
1	Energy, water and food (EWF) nexus literature	Books Journal Articles Published papers	Yes	Not an issue	Not an issue
2	Literature on institutional theory, public policy, public administration	Same as above.	Yes	Not an issue	Not an issue
3	National and State demographic and economic data Historical accounts	Australian Bureau of Statistics Australian Commonwealth and State government department websites and reports Ministerial council reports Independent Inquiries Commonwealth and State Year Books from 1908 to the present Reports from relevant past and present EWF-related organisations: IC, PC, ACCC, AER, NWC COAG Communiques Books Journal Articles	Yes	Some data not available for pre-federation years	Rely on sources available
	Government information: Past and present governments in power, Prime Ministers, Premiers, Past and present ministries, Portfolios, Ministers	Parliamentary Handbooks Parliament Hansards Parliamentary documents from websites Government Gazettes Machinery of Government Changes, Administrative Arrangements	Yes	Complete data not available for all states and territories	Rely on sources available

Specific Objectives	Data Requirements	Data Sources	Data Available	Data Gaps	Strategies to overcome data gap
	Government Organisations	State Archives Government Gazettes Machinery of Government Changes, Administrative Arrangements	Yes	Complete data not available for all states and territories	Rely on sources available
	Information on policy, planning and implementation strategies	Commonwealth and State government policy statements Department reports	Yes	State policy data limited to recent policy documents from last few decades (from 1990s) Physical state policy data located interstate and inaccessible	Secondary sources: Literature from books and journal articles, government documents on history is used to gauge overall policy direction and objectives
	Legislation and regulation	Federal and State Registers of Legislation Trove Australasian Legal Information Institute AustLII	Yes	Legislation may not be available for all years particularly prior to 1900.	Rely on sources available
	Pricing processes	Agency reports Journal articles	Yes	Information not available for all years Detailed information available on pricing processes but at sub-state level, for example, pricing determination for specific utilities	Secondary sources: Literature from books and journal articles, government documents on history is used to gauge overall pricing processes and other relevant sector arrangements
4	Government information	Government Reports Books Journal Articles	Yes	Not an issue	

Sources: Australian Bureau of Statistics (ABS), Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), Australian Energy Regulator (AER), Bureau of Meteorology (BOM), Bureau of Resources and Energy Economics (BREE), Council of Australian Governments (COAG), Industry Commission (IC), Productivity Commission (PC), Australian Competition and Consumer Commission (ACCC), National Water Commission (NWC).

1.6 Significance of research

This research deals with an issue of enormous contemporary significance. EWF security is not only vital for socio-economic development, it is intrinsic to the survival of humanity. Achieving EWF security is a global priority for both current and future generations, particularly for those in poverty who continue to suffer from chronic hunger, water stress and endure a lack of access to needed energy. Resource depletion, environmental deterioration and climate change as a result of human activity and growth has made it increasingly challenging for policy makers to ensure that our basic needs for EWF can be met sustainably. The challenge is intensified due the current global trends in population and economic growth.

Across the world, strategies are being developed to redress EWF security challenges. These current strategies however are likely to fail because they have been developed with little consideration of EWF linkages, that is, the nexus between EWF. This research hopes to contribute to where knowledge is currently limited.

The research is intended to develop an appreciation of the role of institutions as they are the means by which EWF are governed, influencing the degree to which EWF are dealt with together in a holistic and integrated manner or whether they are dealt with in isolation. They furthermore influence the likelihood of policy success, depending on whether both negative and positive outcomes that result from EWF interactions are considered. Also, with emerging technologies that can help to improve EWF security, there is need for developing institutional settings to effectively incorporate these technologies as part of redressing EWF security.

An institutional perspective is developed in the context of Australia to provide a country-level case study to gain insights on the way in which countries govern EWF and hence how they deal with EWF security. The findings that are derived from the analysis are then used to provide recommendations on how the country's institutional settings could evolve to facilitate a nexus approach, needed to better redress EWF security and ensure EWF security in the long term.

The current literature on the EWF nexus does not provide a deep understanding on such institutional dimensions, particularly at a country level where policies are made or at least where the overall economic and development agenda is set, of which EWF sectors have a role.

The analytical framework which is developed and applied to Australia can be applied to carry out case studies on other countries to understand different institutional settings. It may also be applied to develop a cross-country study to compare differences between institutional settings. Such a framework can also be tailored to analyse country-specific EWF nexus issues. The framework can furthermore be applied to examine other interrelationships between other sectors, for example

the nexus between education, labour and health. The emphasis is on moving away from siloed approaches to policy towards integrated policies to ensure positive outcomes.

This research is intended to contribute to the understanding of the EWF nexus, particularly in the context of EWF security as it affects not only Australia but the globe. This understanding is required to better inform policy-making to redress the EWF security challenge as there is an urgent demand for more appropriate solutions.

This research is hoped to produce outputs which will be benefit policy-makers, planners and resource sector managers in EWF sectors and others in the policy and planning field who strive towards sustainable development, including local planners, regional planners and non-government organisations. It may also indirectly benefit businesses that require knowledge on institutional settings that may impact business operations and the certainty of investments, also benefiting investors.

This research will fill a gap in the emerging area of research and address the fragmented nature of existing institutional research. The research may also benefit the research community by adding to the platform on which EWF security issues are discussed, where in which government effectiveness issues and how to deal with interrelated issues can also be discussed. As there is growing attention on this issue, it is also believed that this research could benefit the community at large, who seek to gain from the improved governance of EWF.

As the Brundtland report 'Our Common Future' (1987) suggests, after a legacy of growth that has produced some undesirable consequences environment and society, it has come to our attention that we must meet our human aspirations responsibly and sustainably in a way that does not compromise the natural environment which sustains human life and the lives of future generations. There is a need to plan our current systems sensibly, particularly our EWF systems to meet our basic needs. It is hoped that this research will contribute to meeting this important goal.

1.7 Organisation of thesis

The thesis is divided into 10 chapters. Chapter 2 provides the literature review on the EWF nexus. Chapter 3 provides the theoretical and conceptual background and Chapter 4 develops the analytical framework to develop an institutional perspective based on the Levels of Institutional Analysis Framework for a EWF nexus-based analysis. Chapter 5 provides a historical overview of EWF developments across five periods. Chapter 6 analyses the development philosophies and government involvement of Level 1 and 2 institutions. Chapter 7 analyses decision-making and policy-making structures as reflected in portfolio representation, ministerial responsibilities,

organisations and their responsibilities. Chapter 8 analyses policy, legislation, pricing processes and other sector arrangements. Chapter 9 provides a synthesis based on a discussion of how institutional settings for EWF at all levels have evolved across the five periods, also commenting on state differences. The chapter provides recommendations based on the weaknesses of institutional settings as identified. Chapter 10 presents the main conclusions of this research and presents recommendations for future research.

Chapter 2 A review of the Energy-Water-Food (EWF) Nexus

This chapter reviews the literature on the energy, water and food (EWF) nexus recognising the emergence of the nexus concept as a feature of current EWF security discussion. Consideration of the nexus, that is, the interlinkages between energy, water and food domains, is promoted as a way to better redress EWF security. The following review of the EWF nexus literature develops an understanding of the concept and discusses the main themes in the context of EWF security.

The chapter is divided into five main sections. Section 2.1 discusses the emergence of the nexus concept, explaining the broad definition of the term and also the importance of the nexus in the context of EWF security, which has been considered 'at the heart of the nexus' (Leck et al. 2015, p. 446). Section 2.2 reviews EWF nexus studies to gain an understanding of current knowledge. The section discusses the scale, scope and analytical frameworks of existing studies; the multiple dimensions of the EWF nexus explored and identifies key shortcomings. Section 2.3 reviews in greater detail selected studies that explore institutional dimensions of the EWF nexus which is the focus of this research, and Section 2.4 discusses the limitations of current studies before concluding the chapter in the last section.

2.1 The EWF nexus concept

The EWF nexus refers to the interlinkages between EWF. Framings have also included the nexus between EWF securities, as well as with climate change, environment, land and ecosystems (Keskinen et al. 2015). For example, de Strasser et al. (2016), Vanham (2016) and Karabulut et al. (2016) discussed the energy, water, food and ecosystems nexus.

In 2011, the Bonn Nexus Conference on the EWF nexus (known as The Water, Energy and Food Security Nexus) was the first event to promote the EWF nexus approach (Scott, Kurian & Wescoat 2015) and its importance as a way to enhance EWF security. The EWF nexus approach aimed to highlight the interdependencies of EWF security and 'the natural resources that underpin security' (Hoff 2011, p. 13). The approach was promoted as a means of 'increasing efficiency, reducing trade-offs, building synergies and improving governance across sectors' (Hoff 2011, p. 4). The conference emphasised the importance of the nexus approach in light of accelerating development, urbanisation, climate change, globalisation, degradation of the resource base and growing scarcity of water, land and other resources (Hoff 2011).

The importance of the EWF nexus has risen as the interlinkages between EWF have become more pronounced, particularly as a result of scarcity, leading to trade-offs and externalities. Al-Saidi and Elagib (2017) summarised three drivers behind the emergence of the EWF nexus: 1) increasing resource interlinks due to growing scarcities, 2) recent resource supply crises and, 3) failures of sector-driven management strategies. Ringler, Bhaduri and Lawford (2013, p. 617) state that 'as a result of growing natural resource scarcity, the interconnectedness of these sectors has become more apparent, as evidenced by growing trade-offs and the incipient search for cross-sector efficiencies'. Furthermore, it is seen that the state of natural resources is starting to limit economic and social goals (Ringler, Bhaduri & Lawford 2013, p. 621). Lawford et al. (2013, p. 607) stated that 'there are many interconnections between water and food, water and energy, and water, energy, and food, that lead to such strong interdependencies that integrated solutions are required to address the pressure on the ecosystems that supply these vital resources'.

The nexus between EWF, however, is not considered an entirely new concept. As Middleton et al. (2015) described, the conceptual separation between EWF may not have existed for those such as farmers, fishers and others in the community, those for which the nexus is fairly obvious and known. It is the experts working in sector silos, with their own disciplinary approach to knowledge that has led to conceptual separation and fragmentation of EWF. The EWF nexus concept emerged from the criticisms of such approaches to EWF issues where securities are treated in isolation, in silos, concentrated on sector-specific securities. Ringler, Bhaduri and Lawford (2013) stated that 'despite the strong linkages between EWF, practitioners and policymakers continue to approach development programs and policies in the "silos" of their respective ministries' (p. 621). In the context of Central Asia and the Mekong, in a UNESCAP report, it was found that the energy and water policies and policy frameworks were indeed 'developed largely in isolation from one another' (UNESCAP 2013, p. 7). Bazilian et al. (2011) stated that silo-thinking in terms of EWF is often encouraged by 'different vocabularies, competing priorities, institutional capabilities and regulatory regimes between the three areas' (p. 7902) and it is also due to that fact that there are few experts in all three areas. The siloed approach for dealing with EWF neglects the important interlinkages between EWF that give rise to externalities (both negative and positive) and also transaction costs (Mirzabaev et al. 2015). An inability to consider these interlinkages between EWF with the lack of integration in resource assessments and policy making leads to inconsistent policies and inefficient use of resources (Howells et al. 2013). Howells et al. (2013) suggested that without consideration of EWF interactions, policy-making would be incoherent, with the possibility of a policy in one area undermining another in another area, leading to unintended consequences. Policy incoherence could also lead to an inability to achieve policy goals with implications for EWF security.

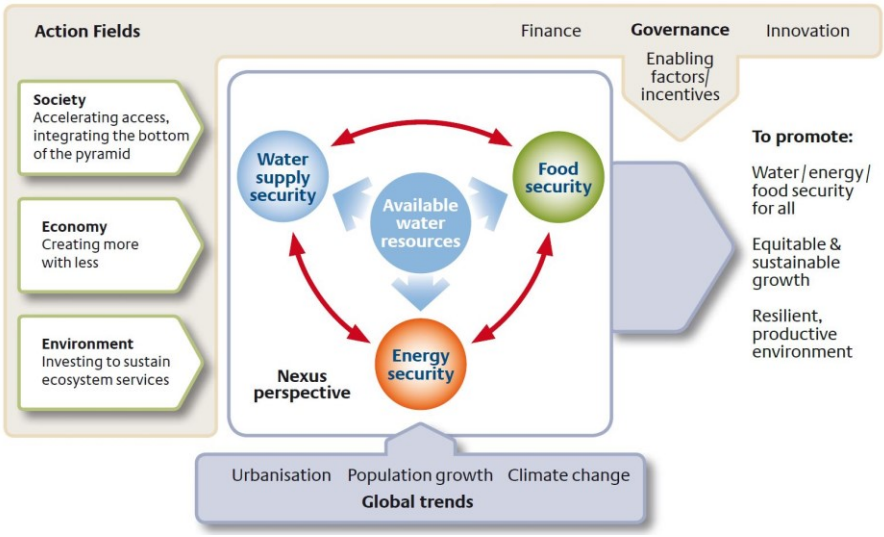
The EWF nexus promotes the consideration of the interlinkages, interconnectedness and interdependencies between EWF. It seeks to reconcile the otherwise separate approaches to the analysis of and policymaking for individual EWF resources. An understanding of these linkages and the associated issues, enabled by integrated frameworks, is needed (Al-Saidi & Elagib 2017).

The application of the EWF nexus concept is promoted to enhance capacity to meet sustainable development outcomes, respond to climate change (Rasul & Sharma 2016) and to support the transition towards green economies (Hoff 2011). In the context of climate change, Rasul and Sharma (2016) stated that the competitiveness of sectoral approaches can be counterproductive, restricting and limiting abilities to adapt. Scott, Kurian and Wescoat (2015) argued that resource recovery is the basis of the nexus, where important resources are saved as a result of improved efficiencies offsetting the further depletion of the resources for which there is rising demand and competition. The nexus approach essentially draws attention to the management of resources and the environment. Villamayor-Tomas et al. (2015) stated,

> *The emphasis of linkages among subsystems constitutes the theoretical core of the nexus approach which argues that although subsystems such as food, water and energy can be analysed independently, doing so would overlook the multiplicity of feedback interdependencies that jointly affect the sustainability of the broader social-economical system.* (p. 736)

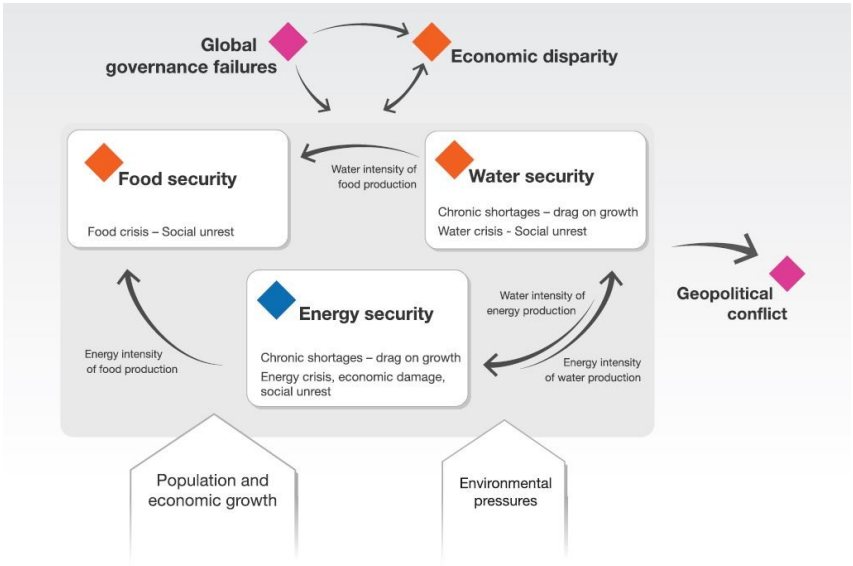
There are various conceptual frameworks for the EWF nexus. The visual representations below depict the EWF nexus perspective, particularly that of the nexus between EWF securities. Each represents the EWF nexus as part of the broader system (social, economic, political and environmental). In Figure 2.1, Hoff (2011) highlights the influence of global trends, the social, economic and environmental aspects and the role of finance, governance and innovation to achieve EWF security as well as growth and a resilient environment. In Figure 2.2, provided by the World Economic Forum, population growth and environmental pressures are seen to influence as EWF securities are also impacted by global governance failures which lead to economic disparity. Geopolitical conflict is a result of worsening EWF security. Figure 2.3, developed by Bizikova et al. (2013), represents EWF security interlinkages within both natural and built systems, within the broader institutional and governance system. Although three visual representations are provided, they are examples of the numerous other representations illustrating the EWF nexus.

Figure 2.1: The water, energy and food security nexus



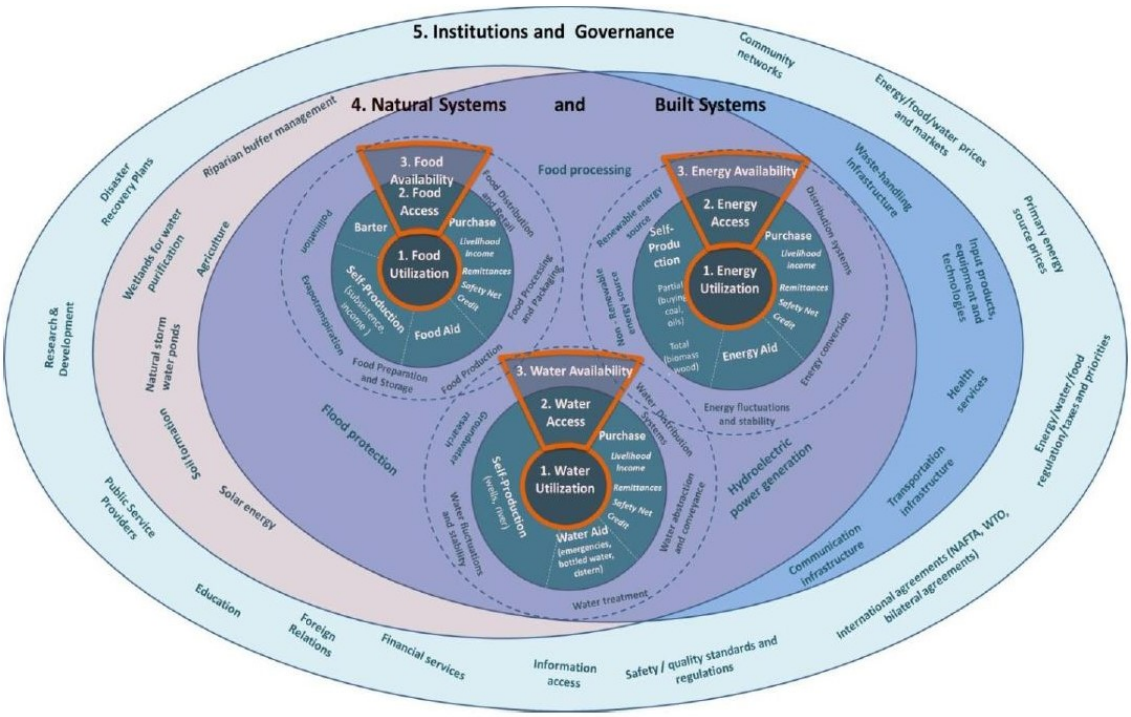
Source: Hoff (2011)

Figure 2.2: System diagram for risks associated with the water-food-energy nexus



Source: World Economic Forum (2011)

Figure 2.3: Framework linking water, food and energy security



Source: International Institute for Sustainable Development, Bizikova et al. (2013)

An understanding of the nexus between EWF securities is increasingly becoming an essential consideration due to its importance especially for the development of EWF security policy. The nexus concept has given rise to a growing body of literature covering a variety of themes and topics from the development of the conceptual understanding of the EWF nexus to the development of analytical tools, modelling frameworks and integrated assessments applied to specific case studies investigating the EWF interlinkages at local, country and also regional levels. The EWF nexus varies across context, according to spatial and temporal factors and is multi-dimensional (physical, technical, environmental, economic, social, political and institutional). The following section provides a literature review on the EWF nexus.

2.2 Review of the EWF nexus literature

Although the 2011 Bonn Conference was a pivotal event to promote the nexus, studies on EWF interlinkages and interactions emerged since 2008. There are also a number of studies on two-way nexuses, linking energy and water, energy and food and water and food. The focus of this literature review is on the three-way EWF nexus. The literature is broad, covering a variety of themes and topics investigating distinct research questions at different scales.

2.2.1 Scale and scope

The majority of EWF nexus studies reviewed were predominantly at a regional and country scale. Most regional studies were based in the Asian continent (Belinskij 2015; Biba 2016; Endo et al. 2015; Foran 2015; Granit et al. 2012; Jalilov, Amer & Ward 2013; Lele, Klousia-Marquis & Goswami 2013; Middleton et al. 2015; Mushtaq et al. 2009; Rasul 2014; Smajgl, Ward & Pluschke 2016; Yang et al. 2016). The studies furthermore, predominantly looked at developing countries as opposed to developed countries.

Many of the regional studies reviewed sought, in particular, to analyse trans-boundary water bodies, with many located in the Asian continent. Analysis at a water basin level was common within the EWF nexus literature. Studies discussed various trans-boundary water bodies, including the Brahmaputra River Basin (Yang et al. 2016) shared by China, India, Bangladesh, Amu Darya Basin (Jalilov, Amer & Ward 2013) and the Aral Sea Basin (Granit et al. 2012) in Central Asia, the Greater Mekong Region in South East Asia (Belinskij 2015; Foran 2015; Middleton et al. 2015; Smajgl, Ward & Pluschke 2016) and Hindu Kush Himalayan Region, a source of ten of Asia's largest rivers (Rasul 2014). Other basin studies included Karabulut et al. (2016) on the Danube River Basin in Europe, Karlberg et al. (2015) on the Lake Tana Basin in Ethiopia, Mayor et al. (2015) on the Duero River Basin in Spain, Kibaroglu and Gürsoy (2015) on the Euphrates-Tigris River Basin in the middle east, and King and Jafaar (2015) on six basins in Northern Africa. De Strasser et al. (2016) developed an integrated assessment for transboundary river basins, and Lawford et al. (2013) discussed basin perspectives of the EWF nexus.

Water basins were an important theme and highly relevant to the EWF nexus. Various interrelated EWF issues could be identified at a trans-boundary water basin level. Water basins play a vital role in supporting the livelihoods and economies of local riparian communities and countries. Water basins provide drinking water and they are relied upon for hydropower to meet energy needs and maintain energy security, to ensure the fertility of agricultural land and for agricultural purposes such as irrigation to maintain food security or to export food to support the economy. They are essential to the overall economy, society and especially ecosystems (Rasul 2014). In water basin contexts, the issues that arise from declining water availability or water cycle invariability are often attributed to unsustainable water use, land degradation and the impacts of climate change, with further pressure from the increasing competition between users of the scarce water resources. A number of studies focused on water issues related to transboundary water basin management between riparian countries and the intraregional impacts of water resources development. The interlinking water, energy and food issues were often a source of conflict between riparian states, both upstream and downstream. Competition and conflict existed

between water users from different sectors including agriculture, food production, or energy production and other industrial sectors. For example, upstream activities such as hydropower operation or related infrastructure development such as the construction of a dam in one country have impacts on countries downstream and their downstream physical water availability, particularly important for food production. The nexus concept highlights the importance of considering potential energy and food issues to inform a more sustainable use of shared water systems to also mitigate potential conflicts between states. For these studies, water was the main focus of analysis within the nexus.

EWF nexus studies at a country level explored a number of topics. Most of these studies were in the context of developing countries, mostly in the African region. In the developing country studies, there was a tendency to focus on food security and agricultural policy in the context of EWF security. Hermann et al. (2012) investigated climate, land, energy and water, what they describe as CLEW interactions, related to agricultural intensification and bioenergy production in Burkina Faso. The study demonstrates the application of their integrated assessment CLEW approach to inform more coherent policy-making in the context of agricultural, energy and water development. Gulati et al. (2013) examined, in the context of South Africa, the interconnectedness of energy, water and food production cycles and how such translates into price linkages, in particular where rising energy and water prices lead to increased food prices, consequently affecting the level of food security. There were two EWF nexus studies in Morocco, one that examined the potential of drip irrigation as a nexus solution because it offers energy and water efficiencies (Jobbins et al. 2015) and the other that examined the energy costs of irrigation policy (Doukkali & Lejars 2015).

Agricultural policy and its links to development was the focus of these country studies. For example, agricultural policy was an important strategy for development in Morocco, particularly irrigation policy and it was similarly important in Ethiopia (Karlberg et al. 2015). Karlberg et al. (2015) examined the impacts and conflicts of Ethiopia's growth plan on agriculture, energy and the environment in the Lake Tana sub-basin. Studies in the Middle East also focussed on agriculture and food production. Talozi, Al Sakaji and Altz-Stamm (2015) and Chahed, Besbes and Hamdane (2015) were concerned with understanding virtual water in agricultural products for informing policies in Jordan and Tunisia. In Daher and Mohtars' Water-Energy-Food (WEF) Nexus Tool 2.0 (2015), the analysis focussed on examining food production and its energy and water requirements. The developed nexus tool was in particular, applied to examine a scenario of food self-sufficiency. Food production was also the focus in Khan et al. (2009) which looked at the environmental footprints of water and energy in food production in Australia.

In addition to food security and agriculture topics, other country studies included Meza et al. (2015) on the EWF nexus in Chile and the challenges of dealing with climate variability, water scarcity and increased competition for resources amongst users; Biba (2016) on the EWF nexus in China and its impacts on its neighbouring countries; Walker et al. (2014) on the patterns of consumption of energy, water and food in cities; Mayor et al. (2015) on basin management in Spain, and Halbe et al. (2015) governing innovation for sustainability.

Country studies reflected country-specific problems associated with the EWF nexus. Interlinkages between EWF varied across countries, leading to differences in EWF challenges and concerns. In the studies of African countries, it was found that agricultural policy and food security was a key issue tied to current strategies for development in the region. Understanding the nexus is important to evaluate the impacts of such development strategies and to identify the possible trade-offs and conflicts with regards to energy, water and food usage and also concerning the economy and society.

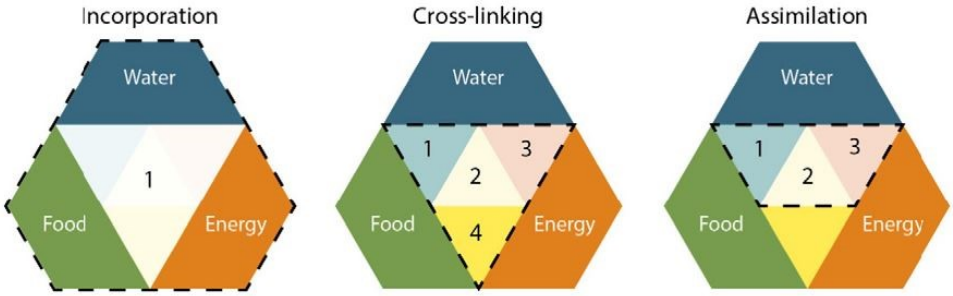
Many of the country studies emphasised the upstream linkages of energy, water and food. The EWF nexus was mostly defined as input linkages where energy, water and food were requirements for the production of each of the resources. For example, scarcity of water was a result of depleted water resources from unsustainable use as well as from climate change. Limited supply of energy resources threatened the production of food, as they were key inputs. Furthermore, if energy prices rise, there would be impacts on the production of food and the extraction of water and this would lead to further socio-economic issues (Zilberman et al. 2008).

2.2.2 Analytical frameworks

EWF linkages and interactions varied according to scale. The interpretation of the nexus also varied. As Al-Saidi and Elagib (2017) described, the EWF nexus has been interpreted as an approach focused on integration, representing an integration paradigm. The authors classified three main ways of understanding the integrated approach of the nexus as evident in the nexus literature, shown in Figure 2.4. The first figure (left) represents *incorporation* which refers to the approach where EWF systems are considered as one system for which each part is important. The middle figure represents a focus on the specific interlinkages and issues defined as *cross-linking*. Examples include hydropower and the associated implications for energy supply, water use and food farming impacted by dams, biofuel production, which includes debates regarding food versus fuel and competition for land and water and irrigation. The discussion of the nexus is concerned with key issues where EWF interact. The third understanding of integration is *assimilation*. This represents the 'sectoral view of operational managers and sector decision-makers trying to include key related sectors in their strategies' (Al-Saidi & Elagib 2017, p. 1136).

This includes examples where the focus is predominantly on water, but energy and food issues are also considered. This integrated approach is common in the studies concerned with water resource management for water basins. Water use is the focus and gives rise to energy and food impacts. Hence, in order to improve water use, energy and food must be considered in water policies and strategies.

Figure 2.4: Three understandings of issue integration in the Water-Energy-Food Nexus



Source: Al-Saidi and Elagib (2017)

Different interpretations of the EWF nexus have led to differences in methodologies to analyse the interactions. Some of the existing methods have been applied to analyse linkages, such as footprint analysis and life-cycle analysis, while others have been developed and tailored specifically to measure EWF interactions and understand linkages with other factors (e.g., climate change).

A number of quantitative methodologies have been applied undertaking three types of analyses. Firstly, the measurement and quantification of linkages between EWF, secondly, the impact of external factors on EWF systems and thirdly, the policy impacts on EWF systems, where alternative scenarios are analysed to understand policy trade-offs. Such analyses can complement each other. For example, an understanding of the nature of physical EWF interrelationships can foster a deeper understanding of the impacts of external factors, such as climate change (through an understanding of the flow-on impacts from one sector to the other as a result of climate change) and this may further enable insights on the potential impacts of policies.

Linkages between EWF were measured and quantified in several studies. This was seen in Peronne and Hornberger (2014) in the use of input-requirement statistics; Mustaq et al. (2009) in the analysis of energy and water efficiency of rice production, using indicators of economic efficiency, and energy and water use efficiencies; De Laurentiis, Hunt and Rogers (2016) using life cycle analysis to analyse the impacts of the production of one resource on another resource in food production; Talozi, Al Sakaji and Altz-Stamm (2015) using virtual water analysis; water

and energy footprints in Khan et al. (2009) and welfare economic analysis in Zilberman et al. (2008), analysing the impact of rising energy prices on water and food systems. Examples of linkages that are measured include energy and water linkages such as water use in energy production, thermal power generation, energy resource extraction and processing, bioenergy production, energy consumption of water supply and management; water and food linkages such as water consumption of agriculture, animal products, beverage products and energy and food linkages such as energy consumption of agriculture, meat products, food and energy coproduction (Chang et al. 2016).

Other studies measured the impact of external factors on EWF. Yang et al. (2016) modelled the impact of the hydrological cycle on water resources to understand resource demands and the impacts on EWF activities in the Brahmaputra River Basin. Mulligan (2015) compared alternative climate scenarios and analysed the implication of environmental changes in water and agricultural production in the African region. Meza et al. (2015) applied system dynamics to analyse the impacts on physical EWF linkages from external factors, including climate change and resource scarcity in different regions in Chile. Karabulut et al. (2016) used the hydrological model, Soil and Water Assessment Tool (SWAT), to map water-provisioning services in the Danube River Basin to analyse the extent to which water needs can be met.

Scenario analysis was furthermore seen in Jalilov, Amer and Ward (2013) in an application of welfare economics to analyse the impacts of two water scenarios associated with the operation of a dam, on energy, water and agriculture for several Central Asian countries and in Walker et al. (2014) in modelling urban metabolism to compare different technologies and their impacts on EWF in the context of a city. Ringler et al. (2016) combined a computable general equilibrium model with an integrated assessment model, linking information from climate models, crop simulation models, and water models to a global, partial equilibrium, multimarket model centred on the agriculture sector to perform a global economic analysis on the impacts of changes in fossil fuel prices on the EWF nexus. To analyse alternative development pathways in Ethiopia, Karlberg et al. (2015) applied Water Evaluation and Planning (WEAP) and Long Range Energy Alternatives Planning (LEAP) models and compared food and energy production. Another quantitative framework by Doukkali and Lejars (2015) included the use of social matrix accounting to analyse the impact of irrigation policy in Morocco. The matrix represented the whole economic system and highlighted the linkages between components of the economy. The multiplier effects relating to the use of energy in agriculture were examined and the framework also enabled analysis of both growth and income distribution.

In discussing frameworks, Bazillian et al. (2011) described various existing tools available for energy, water and food analysis, including MESSAGE, MARKAL and LEAP used for energy

analysis, WEAP, a model used for water system planning, and the Global Policy Dialogue Model (PODIUM) for water scarcity and food security planning. However, as the authors pointed out, there is still a need to improve on these models to enable integrated policy assessment.

A number of specific EWF nexus modelling frameworks and tools have been developed to enable the quantitative analysis of the interrelated impacts of alternative policy scenarios, revealing both policy trade-offs and potential policy impacts. For example, the Climate, Land, Energy and Water (CLEW) modelling framework was developed to link climate, land use, energy and water into one consistent scenario-based framework. It was applied, in the case study by Hermann et al. (2012), to investigate options for agricultural intensification and jatropha-based biofuel production. In order to explore scenarios of increased intensification in agriculture, the study used a geographic information systems (GIS) -based agro-ecological zoning approach (AEZ) model to identify areas of future land extension as well as potential locations for possible biofuel crops. The Global Agricultural-Ecological Zones (GAEZ) model was also used to identify the quantity and location of potential land for agricultural expansion taking into account current areas with agricultural production and current marginal or unused land.

Daher and Mohtar's (2015) scenario-based WEF Nexus Tool 2.0 measured the interrelated impacts of the resource demands of different policy strategies. The authors traced the linkages between EWF, first looking at food products consumed and identifying land requirements, import earnings, water requirements, energy requirements for water and energy requirements for food production. The tool assesses the given scenario by calculating total water requirements, total land requirements, local energy requirements between energy for water and food production, local carbon footprint, financial costs, energy consumed through import, and carbon emissions through imports. Zhang and Vessilinov (2017) developed an optimisation model, WEFO (Water, Energy, and Food, security nexus Optimization) and applied it to quantitatively analyse the interrelationships and trade-offs among system components of energy supply, electricity generation, water supply-demand, food production as well as mitigate the environmental impacts. The model aims to minimise the total system cost with respect to the linkages and constraints in EWF systems.

In addition to quantitative frameworks, there are other types of analyses. These include Biggs et al.'s (2015) Environmental Livelihoods framework which seeks to incorporate the importance of livelihoods and their role in fostering sustainable development, Foran's (2015) perspective based on the regions of provisioning theory, the discussion of environmental justice in Middleton et al. (2015) and the combined value chain and institutional analysis framework in Villamayor-Tomas et al. (2015). Other studies have incorporated stakeholder and expert involvement, as seen in the studies by Halbe et al. (2015) and Smajgl, Ward and Pluschke (2016). Halbe et al. (2015)

combined stakeholder analysis and expert-developed causal loop diagrams to understand how to govern innovation for sustainable development with respect to the EWF nexus. The analysis by Smajgl, Ward and Pluschke (2016) required expert panel methods involving interaction with national policymakers and specialists to identify EWF critical nexus areas in the Greater Mekong Region.

2.2.3 Dimensions of the EWF nexus

The EWF nexus is multidimensional and is influenced by several factors (physical, technical, economic, environmental and ecosystem related, social, political and institutional). The literature reviewed provides insights on a number of these dimensions.

Physical dimension

Managing ongoing resource scarcity is one of the main drivers giving rise to the importance of understanding the EWF nexus. The physical dimension of the EWF nexus refers to the interaction between the physical supply of these resources. As Perrone and Hornberger (2014, p. 59) described, physical scarcity 'relates to the absolute measure of the amount of the resource'. Physical scarcity 'occurs when supply does not meet human and environmental demands, even after accounting for future adaptive capacity' (Perrone & Hornberger 2014, p. 59). Growing demand for EWF as a result of population increase and economic growth is placing increasing pressure on available resources. The development of one sector has the ability to deplete resources in the other two sectors (Chang et al. 2016).

Identifying physical linkages is often the first step in understanding the EWF nexus. As described, water is required for energy production (thermal cooling and hydropower) and is necessary for food production, energy is required for water extraction and treatment, and in food production, processing and transportation and agricultural land may be used to grow biofuels rather than food to contribute to energy supply. The resources are necessary inputs. As described, various studies quantify the physical linkages between EWF, measuring input requirements and efficiencies. With growing scarcity, the emphasis is on achieving greater efficiency and productivity to build more with less (Hoff 2011) and improving the physical supply of EWF resources. Scott, Kurian and Wescoat (2015) also described how improved efficiencies would further delay the rate at which resources are depleted. Infrastructure, however, plays a crucial role in EWF supply. For example, a country that is otherwise water-rich may have a water-stressed population if the infrastructure that provides water is unreliable, insufficient and susceptible to contamination. Physical linkages are important to understand because they have implications for the consumption and use of resources for various activities. For example, scarce water resources give rise to

competition between water users, which often leads to conflict. Scarce water resources restrict food production and energy production, thus compromising both food and energy securities.

Economic and financial dimension

While attention is on the physical scarcities of EWF, economic scarcity is also an important aspect of the EWF nexus and EWF security. Economic scarcity describes situations where a lack of investment in resources and infrastructure prevents communities from being able to access EWF resources, even though there is a sufficient amount to meet demand (Perrone & Hornberger 2014). Hence, EWF are scarce as a result of economic reasons. Economic access to EWF is especially associated with affordability, which highlights the distributional issues associated with the EWF nexus. For example, a country with an abundance of food supply or energy resources may not necessarily be a food or energy secure nation if the population or parts of the population are not able to afford basic food needs or pay for modern energy services. Moreover, the physical scarcity of one resource can drive up not only its price but the price of other resources that require this resource as a production input.

Various studies highlight the economic dimensions of the EWF nexus. Zilberman et al. (2008) measure the impact of energy prices on water and food systems. Gulati et al. (2013) explored the EWF linkages by looking at electricity consumption in primary agriculture, the cost of producing animal feed, oil price trends and other input costs, water pricing, water shortages, food production, virtual water, water quality as well as energy costs. Jalilov, Amer & Ward (2013) measured economic welfare by looking at farm incomes and agricultural and energy production. Ringler et al. (2016) analysed the impact of rising fossil fuel prices and impacts on EWF systems. The EWF nexus optimisation model (WEFO) by Zhang and Vesselinov (2017) focussed on minimising the total system cost with respect to EWF demands. Keulertz and Woertz (2015) considered the financial aspects of the EWF nexus in terms of the options available for financing nexus-based projects in the context of Arab countries.

In considering economic dimensions, although the nexus approach is said to support the transition towards a green economy (Hoff 2011), the way in which natural resources are valued as suggested in Allan, Keulertz and Woertz (2015) is not appropriate to achieve such sustainable development. Allan, Keulertz and Woertz (2015), in reviewing the supply chains of EWF, found that in pricing processes, the costs of over-use, depletion, pollution have not been taken into account and the degradation of environmental resources has been largely ignored. Many of the private sector practices can be attributed to the mismanagement of water and energy, and the impacts of private-sector practices may be felt in later years. The authors argue the need to revalue natural resources ‘as crucial elements in sustainably stewarded global food and energy systems’ (Allan, Keulertz & Woertz 2015, p. 309).

Environmental dimension

The environmental dimension of the EWF nexus is highly important. EWF are resources derived from the natural environment and thus the supply of EWF is dependent on healthy functioning ecosystems. Sustainable development also depends on the way in which EWF are governed in relation to environmental objectives.

Climate change is an important environmental factor impacting on the EWF nexus. Climate change both impacts on and is impacted by EWF linkages (Mulligan 2015). On the one hand, climate change impacts on EWF, for example, through the increased variability of hydrological and climatic cycles, creating uncertainty and difficulties to farm and also by creating more extreme temperatures, requiring the increased use of cooling and heating, thus increasing the demand for energy. On the other hand, processes and activities associated with the production and consumption of EWF furthermore contribute to climate change and also impact on the environment. The use of non-renewable energy sources such as fossil fuels creates pollution and carbon emissions that contribute to climate change, and at the same time, the extraction of energy resources also has negative environmental impacts that are interrelated with water and food. Energy producers compete with food producers for land, which may be both energy resource-rich and fertile. Land devoted to energy may mean a loss of agricultural land and vice versa. Energy production practices also pollute the environment, for example, through coal seam gas and shale gas extraction which can pollute important water resources, not only affecting human drinking water supplies but also affecting the animals and plants that rely on such water resources, impacting on the surrounding ecosystems. Agriculture not only can contribute to sizeable unsustainable water withdrawals but intensive agriculture can also degrade land and soil, compromising the fertility of land and further future food security. Soil is also considered a non-renewable resource as soil formation is a very long process (Ng & Chen 2017). Water activities such as the construction of dams and deliberate water diversions have environmental impacts in changing river systems and natural cycles that agricultural production may depend on and they also lead to the destruction of the natural environment where they are located. Various studies discussed the impacts of dams, particularly in Central Asia (Jalilov, Amer & Ward 2013) and as seen in Yang et al. (2016) which also looked at the hydrological cycle as well as the human activities impacting water resources and therefore energy and food resources. Karabulut et al. (2016) analysed the environmental dimension in their study of mapping water systems.

The environmental dimension is, therefore, an essential consideration for understanding the EWF nexus, particularly as the EWF nexus is framed mostly as a way to achieve sustainable development by fostering improved management of environmental resources.

Social and cultural dimension

EWF are basic needs important for society. EWF play a role not only in consumption but in supporting livelihoods. Secure access to EWF to ensure basic needs are met is important for human development and welfare. EWF sectors impact livelihoods, especially in the provision of employment and way of life. Human behaviour and lifestyles influence EWF consumption and their linkages. Therefore, there is a social dimension to the EWF nexus.

Biggs et al. (2015) argued that in the discussion of the EWF nexus, little attention is given to human livelihoods, which are vital to sustainable development. For example, livelihood activities can 'maintain and enhance or deplete and degrade, the natural resource base' (Biggs et al. 2015, p. 390). The authors highlighted the concept of environmental livelihood security (ELS) associated with the balance between natural resource supply and human demand on the environment to promote sustainability. They developed an integrated nexus-livelihoods framework to examine the ELS of a system. The integrated framework was used to measure and monitor environmental livelihood security of a whole system by accounting for the water, energy and food requisites for livelihoods at multiple spatial scales and institutional levels. The ELS of a system is met when a balance is achieved between human demand on the environmental and environmental impacts on humans. The concept of ELS was intended to address the lack of consideration of livelihoods within nexus frameworks, which is required to ensure EWF securities enable not only sustainable development but also sustainable livelihoods (Biggs et al. 2015).

Social dimensions, although important, appeared to be overlooked. Scarcity perceptions contribute to a narrow framing of the issue, which focus on physical and economic dimensions of the EWF nexus. Some authors pointed out the issue of distributional justice, arguing that much of the EWF nexus discussion has neglected concerns regarding persistent social inequalities that exist and the issues associated with the decisions and structures that determine access to natural resources (Allouche, Middleton & Gyawali 2015; Foran 2015). There are acute issues regarding distributional inequities, such as poverty and the lack of access to these basic needs in various parts of the globe. Current framings of the EWF security nexus have been criticised because social issues have become less important despite initially being promoted as one of the critical goals of implementing nexus-based thinking. For example, Leese and Meisch (2015) criticise the framing of the EWF nexus as being the principal mechanism to foster a new green economy while the needs of the poorest are instead a secondary effect.

Similarly overlooked are the cultural dimensions of EWF which influence the social relationships between humans and EWF resources. For example, religions and spiritual teachings and contemporary mainstream norms provide varied perspectives on how EWF should be treated and what relationships humans should have with nature. Cultural dimensions further inform

ideologies associated with how EWF should be governed which is tied to the following discussion on the political and institutional dimensions of the EWF nexus.

Political and institutional Dimension

Increasing efforts are focused on understanding the nature of physical and economic EWF linkages as well as how they impact or are impacted by environmental factors such as climate change. These insights help in the understanding of the interrelated impacts of potential policy scenarios on EWF, thus informing what types of policy options should entail.

The institutional dimensions of the EWF nexus are complex to understand as it requires an understanding of the underlying political and governance systems that shape policy-making, decision making and the governance of EWF (resources, supply chains, sectors and systems). These aspects directly underpin EWF security responses, as well as influence policy outcomes. Although analytical modelling frameworks can indicate the policy outcomes of a set of possible scenarios, based on mathematical programming and defined relationships, they often do not consider the role of policy processes and governance systems in shaping the development of policy, in implementing, supporting and facilitating these policies and thus in influencing these policy outcomes. Such frameworks cannot account for nor capture the potential disparities in the expected outcomes of policy scenarios and actual outcomes, driven by policy and governance factors. Nor do they question the current policy processes nor the potential reasons why siloed approaches exist in the first place.

While attention is on economic growth and climate change creating pressure on EWF resources, Perrone and Hornberger (2014, p. 50) stated that often overlooked and highly significant are factors related to 'political opposition and the social, behavioural and cultural norms' that limit access to resources, hence influencing levels of EWF security. Current nexus discussion pays little attention to addressing the causes of distributional issues associated with EWF linkages. For example, although a need to address the access for the poor is put forward, there is little discussion on how to do so and less discussion or criticism as to what may produce such issues stemming from current socio-economic and governance systems. Much of the political and institutional dimensions of the EWF nexus are yet to be discussed further in greater detail.

The institutional dimensions are important because while the literature 'seeks to define the inter-relationship between the delivery of services or outcomes related to water, energy and food' there is a need to identify options to better govern and manage the sectors 'that are usually addressed in isolation' (Granit et al. 2012, p. 419). This element refers to questions not only about what policies should entail in order to reflect a nexus approach but how to support a transition towards a nexus paradigm on a larger scale, considering the requirements of implementation and

commitment towards a nexus paradigm for EWF policy. Shifts towards a nexus paradigm must also be consistent with changes in social behaviour, reflecting the way humans at an individual level consider the nexus to further support the more sustainable use or consumption of EWF and related resources. As Scott et al. (2011, p. 6623) described, despite how negative impacts associated with energy and water are recognised, for example, coal developments on natural environments, they are usually treated as externalities and separate from conventional approaches for managing energy and water. An understanding of institutional dimensions could inform the opportunities for internalising externalities and considering the interrelated impacts of EWF.

Despite the importance of institutional dimensions in the context of EWF nexus, the topic of institutional dimensions has appeared to be under-represented in the overall literature on the EWF nexus with less coverage (along with social and cultural dimensions) in comparison to other dimensions. The next section of this chapter provides a review of key studies that cover institutional dimensions.

2.3 Review of key institutional-related studies

The following studies were selected on the basis of the extent of discussion of institutional dimensions. Approximately sixteen publications are discussed with a focus on ten key studies.

Table 2.1: Key EWF nexus studies highlighting institutional aspects

Author	Region	Focus	Institutional Aspects	Comments
Scott et al. (2011)	USA – Southwest, East, Northeast and Central	Water and energy production	Multi-tiered institutional arrangements – decision making processes, laws, policies and organisations that govern resource linkages at different spatial scales	Highlights the challenges of governing energy and water associated with different spatial scales (mitigating local impacts, addressing local and regional priorities, differences in administrative boundaries)
Lele, Klousia-Marquis & Goswami (2013)	China and India	Good governance	Governance of EWF security as reflected in 1) constitutions, property rights, and the role of command and control vs a decentralised democracy, 2) investment in irrigation, infrastructure and institutions, 3) strong and weak records of implementation and 4) incentives, penalties, and participatory approaches	Importance of governance in EWF security. Different governance systems in China and India shaped different water resource management outcomes
Granit et al. (2012)	Central Asia	Regional Cooperation	Potential of regional cooperation through benefit-sharing- frameworks to improve efficient use of EWF across countries	Importance of cooperative over unilateral approaches to managing EWF nexus trade-offs
Stein et al. (2014)	Blue Nile – Ethiopia	Social Networks	'Institutional interplay' - analysis of actor networks and the relationships between relevant EWF actors and organisations also looking at	Highlights the need for greater collaboration across EWF actors

Author	Region	Focus	Institutional Aspects	Comments
			the degree of influence and collaboration	
Villamayor-Tomas et al. (2015)	Germany, Kenya, Spain, India	Value chains and governance across irrigation systems	Interactions between governance structures, agents and actions situations, and resource units and resource systems in the context of irrigation using the Institutional Analysis Framework by Ostrom.	Provides a means for identifying and analysing the role of multiple actors and governance structures that govern EWF resources along the value chain.
Foran (2015)	Mekong Basin	Critical social science perspectives Regimes of Provisioning	EWF systems conceptualised as 'regimes of provisioning', 'aggregation of sector-specific regulatory and planning practices in water, energy and food regimes that impose net costs on poor people, along with possible dispossessing impacts'.	Analysis of the socio-political context of EWF systems considers how systems have been shaped by history and power relations
Gain, Giupponi & Benson (2015)	Bangladesh	Policy Integration	National policies for EWF and the degree of cohesion between policies to properly govern EWF interlinkages	Policy integration between EWF policies is important to manage the EWF linkages and should be incorporated in the policy cycle
Mayor et al. (2015)	Duero River Basin – Spain	River Basin Management	EWF policies and institutions (organisations) and the extent of integration, inclusion of cross-sectorial issues and coordination	Importance of policy coordination to better manage EWF resource linkages and trade-offs at water-basin level
Kibaroglu & Gürsoy (2015)	Euphrates-Tigris River Basin – Turkey, Iraq, Syria	Regional cooperation	Role and benefits of regional cooperation (over unilateral	Importance of high-level coordination, legal instruments

Author	Region	Focus	Institutional Aspects	Comments
			action) to improve the outcomes on EWF management	to strengthen bilateral relations and the political will to address mutual EWF concerns
Jobbins et al. (2015)	Morocco	Drip Irrigation	Institutional barriers to technological nexus solutions that lead to less than expected outcomes. Drip-irrigation has not produced the intended EWF nexus benefits due to constraints associated with its uptake	Need to consider and understand possible barriers to the implementation of policy

Scott et al. (2011) 'Policy and institutional dimensions of the water-energy nexus'

Scott et al. (2011) were the first to discuss policy and institutional dimensions related to the nexus, although only referring to the energy and water nexus and not the three-way EWF nexus.

The study examines the institutional relationships between energy and water and the decision-making challenges associated with considering them jointly. Two central concepts were highlighted: 1) resource coupling (the way in which energy and water are coupled along multiple spatial scales); and 2) multi-tiered institutional arrangements (the laws, policies and organisations across jurisdictional levels for managing resources). Three energy-water nexus case studies based in United States were discussed: 1) water and energy developments in the south-west, 2) impacts of coal development in the east and 3) shale natural gas developments in north-east and central US. Results from stakeholder workshops to understand stakeholder concerns were then used to develop a systems dynamics-based model to analyse alternative energy-based scenarios: 1) Business as usual, 2) Renewables and Natural Gas, 3) Natural Gas, Hydroelectric and Renewables and 4) Coal – each scenario considering energy and water couplings and institutional considerations.

The main findings highlighted three resource concerns and two institutional concerns associated with governing energy and water, emphasising the 'dissonance between the scales of water-energy coupling and levels of institutional decision-making' (Scott et al. 2011, p. 6628). The first resource concern was associated with management challenges due to the spatial dislocation of energy and water sources and demands, where the distance between sources and demands spans multiple jurisdictions, requiring the involvement of both local and state governments that do not often collaborate. The second resource concern was the externalisation of impacts as those benefiting from low-cost coal energy do not prioritise the environmental and water impacts. The third resource concern was associated with the impacts on climate change and the need to manage energy-water linkages in line with long-term climate change mitigation. Institutional concerns included the need for institutional coordination to integrate energy and water management and to bring together multiple parties to negotiate solutions, and the need to reconcile the spatial scales of resource coupling (local impacts of national and global energy demand) through identifying multilevel policy opportunities to align water management and policy with energy policy.

The primary objective stated by authors was 'to move the water-energy nexus construct beyond an input-output relationship into the realm of resource governance, policy and global change adaptation' (Scott et al. 2011, p. 6623) by highlighting the institutional challenges for jointly governing energy and water.

The study is helpful because it draws attention to important considerations, for example, the differences in the physical boundaries of resource linkages and the administrative boundaries of governing resources, emphasising 'territorial mismatch' (2011, p. 6622), and the need to address local impacts (environmental, social and economic) as well as balance local, regional, national and global priorities (which may conflict) that shape energy and water linkages.

The study highlights the importance of the institutional dimensions associated with governing energy and water resource couplings. However, it does not consider food-related linkages, such as the energy and water linkages with and impacts on food and agricultural activities. Its focus is also on specific region-based and sub-national case studies in the US which little emphasis on national energy and water policy. Although the study provides valuable insights, the inclusion of food and agricultural interactions, which are linked to energy and water, to develop a similar perspective could provide deeper insights into the opportunities for the improved governance of energy and water (and food) resources.

Lele, Klousia-Marquis & Goswami (2013) 'Governance for food, water and energy security'

Lele, Klousia-Marquis & Goswami (2013) discussed the importance of understanding the governance challenges of EWF security with a focus on the differences between China and India in their progress of achieving EWF security outcomes, as two examples of countries with significantly different governance settings. China and India represent two different archetypes of centralised and decentralised, authoritarian and democratic systems and both countries comprise a significant proportion of the global population. Governance issues were also discussed at the international level, particularly in the context of sharing water resources.

In order to develop an understanding of governance, the article discussed the Worldwide Governance Indicators as a measure of governance. It also cited the definition provided by FAO (2011) as the 'formal and informal rules and processes through which interests are articulated, and decisions relevant to food security in a country are made, implemented and enforced on behalf of members of a society' (Lele, Klousia-Marquis & Goswami 2013, p. 56).

The article argued that the differences in EWF security outcomes between the two countries was a result of the differences in governance. For example, China's performance in political stability, government effectiveness and regulatory quality, ranking higher than India, explained the effectiveness of its water policies. Four themes were analysed: 1) constitutions, property rights, and the role of command and control vs a decentralised democracy, 2) investment in irrigation, infrastructure and institutions, 3) strong and weak records of implementation and 4) incentives, penalties, and participatory approaches. A comparison was made between the role of the government in both countries, highlighting the command and control approach in China compared

with the lack of control and accountability in India. Differences were also seen in the levels of investment in irrigation with substantially lower levels of investment and support of systems in India. It was found that China was progressing more towards a 'balanced approach to the strategic management of water than India' (Lele, Klousia-Marquis & Goswami 2013, p. 61). India was not adequately addressing its water sector issues and required a more holistic strategy. While it was not suggested that India adopt China's ways of governing, it was the differences between that enabled an understanding of the country's challenges.

While the article is useful as it sheds light on the importance of governance, the discussion of governance is mostly in the context of the separate sectors rather than on the joint governance of all sectors. The article furthermore, emphasises the water sector over energy and food sectors.

Granit et al. (2012) 'Regional Options for Addressing the Water, Energy and Food Nexus in Central Asia and the Aral Sea Basin'

In Central Asia, a region where conflicts between upstream and downstream states exist, Granit et al. (2012) explored the importance of regional cooperation as a means to promote more efficient water use for energy and food production and attention to environmental issues in the Aral Sea Basin. The study discussed how a system of cooperation based on benefit-sharing between countries previously existed during the Soviet Union but since its collapse, how countries have opted to act independently.

The main point put forward concerns the potential for regional cooperation between the countries in Central Asia to enable more efficient use and consumption of EWF resources and EWF security in the region and improved environmental outcomes. It is suggested that regional cooperation could lead to an integrated approach towards managing EWF.

In particular, regime theory and benefit-sharing theory were discussed. Benefit-sharing theory in transboundary water resource management and development referred to 'the basic principle that countries cooperate if the net benefits of cooperation are perceived to be greater than the net benefits of non-cooperation and if the distribution of these benefits is perceived to be fair within and beyond the river basin' (Granit et al. 2012 p. 412 cite Sadoff & Grey 2002). The authors described regional economic cooperative frameworks and regional water cooperative frameworks.

It was argued that given there are existing mechanisms for coordination (seen in the participation of countries in various multinational organisations), there is a role for regional policy to improve governance and management in the nexus. The authors stated that 'collaborative management and development of transboundary water resources in the Central Asian region is central to meeting future water, energy, food and environmental security needs' (Granit et al. 2012, p. 429). While

cooperation poses a solution, the challenges of achieving such cooperation are acknowledged. The absence of a hegemon (previously the Soviet Union) to impose needed cooperative regimes limits the prospect of ensuring that countries cooperate.

The study is useful as it highlights the importance of cooperation between countries to better deal with EWF issues. While the study has an international focus, similar analysis could be applied to understand the scope for cooperation and benefits for states within a country (sub-national contexts), particularly where resources are shared, e.g. transboundary water sources.

Stein et al. (2014) 'Advancing the Water-energy-food nexus: social networks and institutional interplay in the Blue Nile'

Stein et al. (2014) analysed the water-energy-food nexus in the Blue Nile, Ethiopia with an emphasis on the entities that influence the nexus and their coordination, and their role in achieving economic and environmental objectives as reflected in national policy. The study focussed on the mapping of actor networks to understand the relationships and interactions of actors from otherwise separate EWF sectors.

The study is based on developing a network perspective that highlights the relationships between actors (individuals, organisations or other groups) and considers the 'institutional interplay' within networks to understand how arrangements of actors influence each other. With an understanding of existing arrangements, actors can forge strategic links between institutions to pursue individual or collective goals (Stein et al. 2014, p. 4) and this was an important aspect of facilitating coordination among EWF actors. To identify actors that influence the EWF nexus and then to explore challenges, the authors used participatory network mapping and focus group discussion to develop networks maps. These were used to identify the number of collaborative relationships.

Three cross-cutting nexus areas were analysed: 1) energy management and use and the importance of biomass-based energy, 2) agricultural water management and 3) ecosystems and the nexus. The main findings included that, in the context of energy management, the institutional arrangements were inadequate as they neglected the importance of biomass energy, instead focussing on hydropower and other technological areas. There was a need to reflect the needs of rural communities. In the context of agricultural water management, the analysis of responsibilities revealed both fragmentation and overlaps with a need for coordination across sectors and scales and clarity of roles and responsibilities. In addressing ecosystems and the nexus, it was found that those working in environmental areas had little influence than others of other sectors, hence revealing priorities of economic development rather than environmental conservation.

This study is useful as it analyses the interaction between actors from different sectors and scales, exploring how they relate to each other to coordinate their activities in EWF. The mapping of interactions enables an understanding of institutional arrangements, linkages and opportunities for more collaborative relationships to enhance sustainable resource management. The issues addressed in the study are associated with the adequacy of institutional arrangements: actors and their responsibilities, and the need for coordination across sectors and scales and for strengthening their influence. The focus is on the institutional arrangements that comprise those who are responsible for EWF resources.

Villamayor-Tomas et al. (2015) 'The Water-Energy-Food Security Nexus through the Lenses of the Value Chain and Institutional Analysis'

Villamayor-Tomas et al. (2015) combined the Institutional Analysis Development (IAD) framework developed by Ostrom et al. (1994) along with value chain analysis to analyse the EWF security nexus. The study used value-chain analysis to identify the linkages between EWF production processes and then the IAD framework to examine the role of multiple actors and governance structures in governing EWF resources within and along production processes.

The motivation of the study was based on what the authors described as the neglect of the role of 'institutionally mediated human agency' in the current literature surrounding the EWF nexus, commenting that many of the frameworks have a 'processes-based approach to resource use and a preference for systems analysis and modelling over other empirical strategies' (2015, p. 736).

The combined IAD and value-chain analysis framework was applied to analyse four specific irrigation case studies (Germany, Spain, Kenya and India). Irrigation activities were chosen for the analysis as they represent clear linkages between EWF resources and where it is evident that governance structures to manage resource use are needed.

The framework first involves value chain analysis to identify the resource links along EWF production processes to trace input-output relationships and second, the IAD framework. The IAD framework consists of four main components: 1) resource units, 2) resource systems, 3) actor groups and 4) governance systems and the interaction between components are analysed.

EWF value chains are seen as networks of action situations. These situations involve the decisions of actors that are shaped by the institutional structure in the given situation, which in turn, influences the use and production of resources. Policies, for example, are considered as 'amalgams of institutions' and are those that influence the use and production of EWF resources. They also 'mediate the emergence of trade-offs and synergies' that result from production processes (Villamayor-Tomas et al. 2015, p. 737). The analysis shed light on how institutions shape EWF linkages along the value chains – how institutions that shape outcomes in one action

situation can affect the subsequent action situations, also affecting multiple action situations simultaneously.

The case studies explore the differences in irrigation contexts in each of the countries, showing differences in the number of actors involved and their interactions, and the differences in governance structures in place to regulate actors' behaviour to govern resources. The German case study shows the possibilities of cross-sectoral coordination to enhance the management of wastewater, food production and biogas production. The Spanish case study shows the influence of national initiatives in one sector on local actions of other sectors and the processes actors engage in to cope with energy prices and secure energy for water. The Kenyan case study shows the interaction of national and local level governance of water (particularly the use of Water Resource Users Associations) to manage use and resolve conflict. The Indian case study highlights the existence of path dependencies (e.g., the inability to remove subsidies) and the difficulties of encouraging investment and coordination in governing both energy and groundwater.

The case studies are insightful as they draw attention to the importance of institutions. The framework brought attention to the linkages between EWF in terms of the governance structures that shape EWF linkages through influencing actors' decision-making and behaviour along the value chain. The interactions between governance structures, actors, actor situations and resources unit reflect the processes by which EWF resources are governed and environmental impacts are mediated.

While the study is useful, it is however limited in scope, focussing on irrigation case studies, which is a specific nexus issue. It does not consider the broader contexts for which EWF resources are governed outside irrigation activities.

Foran (2015) 'Node and Regime: Interdisciplinary Analysis of Water-Energy-Food Nexus in the Mekong Region'

In response to the dominance of complex systems thinking approaches to understand the EWF nexus, Foran (2015) argued for a critical social science approach – one that accounts for the historical, cultural and socio-political dimensions of the EWF nexus. Although complex systems thinking approaches have been helpful, they were often described as 'depoliticised and ahistorical' (Foran 2015, p. 668), hence limiting a full understanding of the EWF nexus.

The concept of the regime of provisioning in the context of the EWF nexus was developed with a focus on the 'multilevel system of beliefs, rules and contestation between incumbents and challengers' (Foran 2015, p. 663). What is gathered from the article is that the way in which EWF is governed, produced, distributed and consumed reflects systems of provision and the relevant

policies in place and the forces that drive them (ideas, institutional arrangements that channel attention and resources, and interests) reflect the regime of these systems. There are four key components of a regime of provisioning: a) social rules, values and belief systems, b) planning, regulatory and market practices, c) local development context, d) local lifestyles and livelihoods – each component having an influence on the next. The nexus, as described by the author, is interpreted as the 'superimposition of regimes: aggregation of sector-specific regulatory and planning practices in water, energy and food regimes' (Foran 2015, p. 655). Together these regimes 'impose net costs on poor people, along with possible dispossessing impacts' (Foran 2015, p. 665).

To demonstrate the importance of a critical social science approach, the author re-examined the analysis by Smajgl, Ward & Pluschke (2016) on the EWF nexus in the Mekong Basin, challenging the findings and recommendations of action with regard to 'critical nodes', described as areas that needed to be managed to reduce negative impacts that result from EWF linkages. Foran examines three: energy demand, fish stocks, and land use change and irrigation. Applying the regimes of provisioning concept, the author discussed path dependencies, the difficulties of changing regimes (for example, to provide greater energy choices or to re-regulate and alter investment practices) and the inadequacies of current regimes (for example, the neglect of regimes to include multilevel fisheries management systems). Impacts of the nexus, as described by the author, were not just 'impacts of development projects but impacts of EWF regimes of provisioning from which such development projects arise' (Foran 2015, p. 668).

The study is helpful as it draws attention to the socio-political context of the nexus which considers EWF systems as being shaped by historical and socio-political dimensions. It also highlights the importance of power relations and power imbalances and distributional issues, such as how specific regimes may impact on poorer groups of society. It emphasises the need to understand the impacts of the EWF nexus and possible reasons as inherent in EWF regimes.

Gain, Giupponi and Benson (2015) 'The water-energy-food (WEF) security nexus: the policy perspectives of Bangladesh'

Gain, Giupponi and Benson (2015) developed a policy perspective on the EWF nexus with an emphasis on policy integration as a means for holistically dealing with EWF issues and achieving EWF security. The EWF policies of Bangladesh, a country facing EWF security challenges, were examined to identify the extent of linkages and hence the extent of integration evident in EWF policy. The three policies were the National Food Policy, National Energy Policy, and National Water Policy.

Finding little EWF integration in policy documents, with interaction between water and food evident in the country's food policy, the authors suggested the need for policy integration, which

was seen as a way to minimise negative outcomes (inefficiencies) by facilitating greater coordination of the existing policies. Gain, Giupponi & Benson (2015, p. 902) cite Briassoulis (2004), describing policy integration as the 'process either of coordinating and blending policies into a unified whole or of incorporating concerns of one policy into another'. It can also include the process whereby policies can 'unilaterally integrate characteristics of another policy to improve compatibility' (Gain, Giupponi & Benson 2015, p. 902).

It was argued that policy integration can be accomplished within the first three stages of the policy cycle, in the stages of agenda setting, policy formulation and decision-making. Emphasis was on enhanced collaboration in order to achieve a 'higher level of policy integration for the WEF nexus approach' (Gain, Giupponi & Benson 2015, p. 906). Enhanced collaboration, as described, should include problem-solving processes with different stakeholders, policy formulation with the participation of professionals, improved dialogue between stakeholders, experts, professionals, non-governmental organisations (NGO's) and private sectors, inter-ministerial meetings and consultations.

The study provided a policy perspective of the EWF nexus, examining the policy cycle to assess opportunities for policy integration of EWF policies in Bangladesh. The focus on policy processes was to highlight the implementation of the EWF nexus. The study is useful as policy integration is an essential aspect of the overall implementation of the EWF nexus approach in governing EWF. While policy integration can be an option for specific contexts, there is also a need to consider both the organisations and persons involved and even the broader institutional settings concerning both formal and informal aspects of rules and constraints. Although collaboration in problem-solving and enhancing dialogue for coordination is emphasised, there is little in the article that explains how collaboration (to foster processes of policy integration) could be achieved, more so overcoming the barriers to collaboration. As the opportunities for collaboration and coordination may vary across contexts, achieving such may be easier said than done. Political will is an important aspect for policy and also integration, as described in the article. When the potential of social conflict is high, political will to control outcomes is likely to be strong (Gain, Giupponi & Benson 2015, p. 903).

Mayor et al. (2015) 'Application of a water-energy-food nexus framework for the Duero river basin in Spain'

In Mayor et al. (2015), a conceptual framework for the EWF nexus is presented, and an assessment methodology is proposed to guide implementation at the water-basin level. The methodology is applied to a case study of the Duero River Basin in Spain, seeking to identify EWF nexus trade-offs and synergies, diagnose the level of political coordination and identify existing and potential solutions.

The assessment methodology proposed consisted of three steps: 1) the identification, accounting and description of the main trade-offs, 2) an analysis of the level of integration and coordination of sectoral policies and institutions, and 3) a discussion of the existing and potential strategies to mitigate conflicts and promote synergies. The second and third steps of the methodology are relevant for understanding the institutional aspects of governing EWF trade-offs. The importance of understanding the EWF nexus in the context of the Duero River Basin was associated with the recent experience of resource management conflicts and, in particular, the unintended consequences of irrigation policies that have failed to bring about water savings and ensure farmers' livelihoods.

The findings of the study revealed important linkages between EWF associated with competition for water resources from both the energy and food (particularly agriculture) sectors, and the impacts on water quality; biofuels linking food for energy and the implications of modernising irrigation which have exposed farmers to higher energy costs.

The analysis of integration in policy and institutions showed that energy, water and agriculture policies in the Duero basin had been developed and implemented independently. Policies had been made at different scales, for example, water planning at the basin scale, energy and food planning at the national scale. Differences in competencies and a lack of communication led to several conflicts and difficulties in coordinating policies. The analysis of regulation and planning processes, however, found increasing coordination and inclusion of cross-sectoral impacts, but this was also seen to be carried out by separate institutions (organisations) with little coordination between them. Overall, there was a lack of communication and coordination between sectors and policies and this was seen to have led to unexpected outcomes. Some of the main challenges found included finding ways to balance energy prices to allow farmers to cope with irrigation energy costs, less energy-costly wastewater treatment solutions for small villages, safeguarding the integrity of rivers segmented by hydropower, and the creation of social awareness.

The analysis however also showed that in the Duero Basin, progress had been made and this was seen in the greater involvement of both the Duero River Basin Organisation and the Spanish government and a growing recognition of the importance of developing policies that consider resource interlinkages. For example, the River Basin Organisation had engaged in several initiatives, including promoting the creation of groundwater user associations, conducting workshops on water system sustainability and processes to review and update all hydropower concessions in the basin to ensure compliance with legislation. Two measures were suggested to help identify existing and possible conflicts among policies and then develop prevention or mitigation strategies: first, public participation in energy planning, as seen in current water

planning and second, an evaluation of the energy footprints of irrigation modernisation and further examination of energy trade-offs for water availability to assist in water planning.

This study is beneficial as it not only includes an assessment of EWF resource interlinkages and trade-offs, it also seeks to analyse the relevant policies and institutions (organisations) with a view to understand the issues and develop solutions. Issues are primarily associated with a lack of policy cohesion and coordination that led to conflicts, unintended outcomes and resource inefficiencies. Emphasis is placed on how EWF trade-offs were treated. The limitation of the study is, similar to other studies, its focus on basin-level issues to the exclusion of other broader issues related to EWF linkages.

Kibaroglu & Gürsoy (2015) 'Water-energy-food nexus in a transboundary context: the Euphrates-Tigris river basin as a case study'

Kibaroglu & Gürsoy (2015) explored EWF nexus management of riparian countries, Turkey, Syria and Iraq. In the context of the Euphrates-Tigris River Basin, the study examined the changes in transboundary water management policy, finding that a shift from unilateral and competitive policymaking to more coordinated and cooperative policymaking had been beneficial in the management of water in the region, improving political relations and economic trade between countries. The previous unilateral approach of domestic EWF policy-making led to 'ecosystem losses and political disputes' (Kibaroglu & Gürsoy 2015, p. 827).

Policies since the 1960s were examined to analyse the shift from competition between countries towards greater transboundary nexus cooperation. It was found that greater regional cooperation between countries was facilitated by the Joint Political Declaration on the Establishment of the High-Level Strategic Cooperation Council in 2008 signed by Turkey and Iraq. This Council brought together different sectors and highlighted the important role that EWF sectors had in regional economic cooperation. Negotiations regarding economic development also sought to include water, energy and agricultural development cooperation for which transboundary waters was an important aspect. In 2009, Turkish and Iraq government departments (Ministry of the Environment and Forestry and the Ministry of Water Resources, respectively) signed a Memoranda of Understanding concerning water where government departments were responsible for water development and the protection of water resources.

The study found that political will, recognition of mutual issues and high-level contacts enabled frameworks for regional economic cooperation. Although progress had been made, political instability and shifting power within the region, attributed to the civil war in Syria and growing instability in the region, had become barriers to further coordination between countries. The study concluded that mutual benefits for riparian countries and national natural resource constraints can

be alleviated through transboundary cooperation, infrastructure development and trade among countries in the region.

The study is insightful as it demonstrates the possibilities of cooperation stemming from improvements in political relations, highlighting the importance of the political dimensions of nexus governance. It also includes a historical analysis to show how policies have evolved.

Jobbins et al. (2015) 'To what end? Drip irrigation and the water-energy-food nexus in Morocco'

Jobbins et al. (2015) examined the adoption of drip irrigation in Morocco as a solution benefitting small farmers to manage the nexus, given that drip irrigation was found to be both water and energy efficient. The study proposed a framework to assess whether small farmers benefitted from drip irrigation, exploring three questions: 1) whether small farmers have been able to adopt drip irrigation, 2) whether the adoption of drip irrigation has improved water, energy and food security and how and for whom, and 3) whether drip irrigation has affected other markets of poverty.

Using three case studies on rural communities and areas (Bitit and Ain Chegag, Sebou; Lamzoudia, Tensift; Guerdane and Issen, Souss Massa), the study found that drip irrigation, despite being a promoted nexus solution, did not reach its expected potential and a key reason for this was due to institutional barriers. Issues included land tenure and ownership, access to subsidies and services and other administrative complexities. Furthermore, some farmers did not have enough economic reasons to invest in drip irrigation.

Jobbins et al. (2015) raised an important point that technical solutions may not be sufficient if the potential institutional barriers have not been identified and planned. The authors stated that technical options which appeared to be beneficial and appealing at the conceptual level can produce unintended consequences in practice. Furthermore, policies that focus on issues of scarcity and efficiency may exacerbate other social outcomes such as dimensions of poverty and inequality. The risk of such unintended consequences requires further assessment of policy options. Ensuring the proper uptake of technology was found to be complicated because of complex institutional barriers to access and also insufficient incentives to ensure that users save water or energy. An understanding of the incentives was found to be an important consideration for implementing technical solutions to manage the EWF nexus.

Others studies

In addition to the aforementioned literature, other studies discussed institutional dimensions, however to a lesser extent.

Halbe et al. (2015) combined stakeholder analysis and causal loop diagrams to understand how to govern innovation for sustainable development with respect to the EWF nexus and in the context of Cyprus. The causal loop diagrams were used to identify linkages between EWF domains. The study examined several potential sustainable innovations, including organic agriculture, adapted agriculture, urban gardening, aquaponics, aquifer recharge, rainwater harvesting, decentralised renewable energy systems and conscious water, energy and food use. The authors developed an understanding of the learning requirements associated with innovations and the responsibilities of stakeholders to support sustainability transitions. Halbe et al. (2015) addressed the need for the governance of innovations related to the EWF nexus. The study, however, does not examine the governance of EWF linkages.

In Bromwich (2015) the relationship is drawn between improved governance to respond to conflict in order to better manage the long-term natural resources and the EWF nexus in the context of Darfur, Sudan. The author linked the EWF nexus with natural resources and conflict.

In line with enhancing transboundary water management, Belinskij (2015) discusses how international water law can support the EWF nexus by fostering cooperation between states and sectors. As described, the use of water in transboundary basins gives rise to potential conflicts that impact on the EWF nexus. International law has a role in supporting the appropriate use of shared water sources between countries. The author concludes that despite its deficiencies, international water law provides a useful platform for cooperation between states and different sectors that aim at guaranteeing EWF security.

Also concerned with transboundary water, de Strasser et al. (2016) developed a nexus assessment for transboundary river basins. The objective of the nexus assessment is to identify the trade-offs and impacts across sectors and countries and to propose possible policy measures and technical actions at national and transboundary levels. The assessment was done jointly with policymakers and local experts. The study pointed out the need for integrated resource planning to respond to needs of policy. Understanding governance is essential as several issues may exist including ‘overlaps in institutional mandates, lack of compatibility of geographical and political scales, differences in policy or enforcement culture, lack of consistency in regulations of even power imbalances’ (de Strasser et al. 2016, p. 2).

The analysis of governance aspects is a key component of their assessment. Governance is defined as a ‘system of responsibility and accountability involving formal and informal institutions that builds trust and capacity to cooperate in policy-making, decision-making and implementation measures’ (de Strasser et al. 2016, p. 8). The governance analysis includes three components: 1) policy framework referring to strategies and other policy documents and instruments, 2) legal and regulatory framework, referring to rules and regulations, and 3) organisations and actors –

mandates, responsibilities and administration. The methodology is helpful as one of the strengths mentioned is its parallel analysis of resource flow and governance of resource flows, which enables an identification of policy incoherencies and gaps in other institutional and legal frameworks, similar to the study by Mayor et al. (2015). The authors also recognised that it was limited by its over-representation of water over other sectors, which excludes other essential energy and food linkages.

In the proposed hydro-economic water system modelling framework, Yang et al. (2016) developed thresholds to allow the distinction between acceptable trajectories and unacceptable trajectories – these were used to reflect institutional aspects. Historical data was used to understand such thresholds. For selected countries, unacceptable basin trajectories were those that entail below average crop production or lower than required hydropower production. The classification of acceptable and unacceptable scenarios was seen to help policymakers understand what is viable and hence can be an essential input for policy-making. However, the definition of acceptable and unacceptable was only based on economic aspects. It did not consider other factors that may influence the acceptability of a particular trajectory, such as environmental impacts or local social impacts related to displacement as a result of dam construction. The interpretation of institutional aspects was hence narrow.

On the topic of decision-making related to the EWF nexus, Howarth and Monasterolo (2016) identified four barriers, as revealed from stakeholder workshops which included government, industry professionals and researchers. The four barriers were: 1) communication and collaboration, 2) decision-making processes, 3) social and cultural dimensions 4) the nature of responses to shocks. Building dialogue was essential to overcoming these barriers.

Kurian (2017) discussed the importance of the governance dimension in the analysis of the EWF nexus, however focusing broadly on sustainable development regarding environmental management and resource use and not explicitly addressing EWF security. A particular focus was on water, soil and waste. The study developed an integrated index combining biophysical, institutional and socio-economic indicators to explain public responses to wastewater use. The index measures the effectiveness of wastewater resources across different countries considering their institutional and socio-economic framework (ISEF). The ISEF comprised four dimensions: cost recovery; governance and political stability; income and charges; and communities' and policymaker's awareness.

Summary

The previous section reviewed key studies that discussed various aspects of the institutional dimension of the EWF nexus covering policy, governance structures across multiple levels and

value chains, law, regimes, actors, the role of organisations as well as the importance of political and social contexts.

The aforementioned literature highlighted a number of key challenges in governing EWF jointly for EWF security, for example, resulting from spatial differences and the involvement of multiple levels of government (Scott et al. 2011), differences in national governance structures (Lele, Klousia-Marquis & Goswami 2013), a lack of willingness to cooperate on mutual concerns (Granit et al. 2012; Kibaroglu & Gürsoy 2015), a lack of policy integration (Gain, Giupponi & Benson 2015; Mayor et al. 2015), multiple actors involved (Stein et al. 2014; Villamayor-Tomas et al. 2015), path-dependencies and political forces (Foran 2015) and preoccupation with technological solutions (Jobbins et al. 2015).

In considering nexus governance, emphasis was placed on the importance of what could be described as five necessary prerequisites: consistency, cohesion, coordination, cooperation and collaboration. In order to achieve EWF nexus governance to manage trade-offs and synergies more effectively, EWF policies should be consistent and cohesive to minimise unexpected policy outcomes and the involved parties, such as organisations, should cooperate to ensure policy cohesion (Gain, Giupponi & Benson 2015; Mayor et al. 2015). Cooperation between jurisdictions at a regional level (Granit et al. 2012; Kibaroglu & Gürsoy 2015) and a sub-national country level (Scott et al. 2011) should be fostered in order to consider nexus impacts at different scales to plan accordingly and this requires increased collaboration across EWF sectors. Such cooperation could ensure a shift from siloed policy-making to a nexus approach, where issues pertaining to each resource can be addressed in an integrated manner. The shift requires that actors work together to formulate more appropriate and integrated policy to produce better EWF outcomes. The studies reviewed provide useful insights into institutional dimensions at different scales from transboundary to country contexts.

2.4 Limitations of current literature

The aforementioned studies highlighted important points regarding the future vision of nexus governance, however knowledge appeared lacking and fragmented. Institutional dimensions are broad and can be analysed from different angles and at different scales. Although the studies discussed aspects related to policy and governance, a unified institutional analysis framework or common language, such as common terms for governance and institutions, was not evident. Institutions were described ambiguously, either as rules or organisations, with no clear definition. Therefore, it was not clear what was meant by institutional challenges. Another point is that there was also a dominant focus on transboundary water-basin nexus governance, which excludes other important energy and food linkages. Much of the attention of EWF nexus governance was on the

context of water governance. Issues in energy and food governance were secondary and only considered in the context of water systems.

To contribute to the growing knowledge of the EWF nexus, there is a need for the further analysis of institutional dimensions. In their literature review of EWF nexus studies, Al-Saidi and Elagib (2017) argue that nexus governance is the missing link in the nexus debate. The authors cited Allouche, Middleton and Gyawali (2015), saying that the 'nexus idea has not yet permeated to the level of national government or led to the evolution of a "nexus bureaucracy" '(Al-Saidi & Elagib 2017, p. 1133), questioning what the integrated approach of the nexus means for institutions and actors both of the state and the market. The authors found that the current literature was 'less clear regarding the institutional reforms and participatory measures needed to achieve the nexus integration vision' (Al-Saidi & Elagib 2017, p. 1136). This was evident in the above review.

The EWF nexus literature looked at a number of dimensions and aspects that need to be considered for policy making. A number of analytical frameworks have been developed to assist policymakers in understanding a range of policy impacts to eventually achieve nexus policy and governance. Various solutions have been discussed. For example, in promoting the nexus approach, much of the literature, since the first nexus paper at the 2011 Bonn Conference, has stressed the need for policy cohesion, the collaboration between sectors and coordination to reflect nexus considerations in policy-making and the governance of EWF resources. This was emphasised in the key studies reviewed above. Cross-sectoral integration and regional integration is needed to improve resource use efficiency (Rasul 2014). Regional cooperation was also emphasised in order to reduce conflicts that may exist between different countries that share resources (water basins) to enable a more efficient use of water for energy and food production and the better management of the EWF nexus at a regional scale (Granit et al. 2012). Improved EWF outcomes as a result of regional cooperation were evident in the experience of regional cooperation in Turkey, Iraq and Syria. The key studies reviewed in the previous section highlighted possible solutions.

Al-Saidi and Elagib (2017) list, what was described as simple remedies for the integration of institutions, policies and actors as promoted in literature. However, the authors stated that such remedies are only mentioned marginally. These remedies included institutional arrangements and participation forms based on management level (see Table 2.2). At a macro-policy level, this may include integrated plans and super-ministers; at a meso-level, this may include coordination and regulation; and at the sector-level of day-by-day management, this may include nexus-smart sector policies (Al-Saidi & Elagib 2017, p. 1136). Each type of remedy is also classified in terms

of the understanding of nexus, as incorporation, cross-linking and assimilation. Other remedies include the development of dialogue platforms or interagency mechanisms (Beisheim 2013)

Table 2.2: Examples of institutional and participatory arrangements for the EWF nexus

Management level: Nexus Understanding	Institutional Arrangements	Participation forms
Policy formulation and investment planning: incorporation	• Joint National Plans (e.g. Integrated Resource Plans. Or IRP's in South Africa) • Nexus National Strategies. Nexus-SDG's implementation strategies • Super-ministries	• National Environmental Councils
Coordination & regulation: cross-linking	• Joint Laws • Dam guidelines	• Reform steering committees
Operational management: assimilation	• Integration National Water Plans • River Basin Organization • Nexus Smart Sector Policies	• Stakeholder Platforms • Advisory boards

Source: Al-Saidi and Elagib (2017)

Even though solutions have been put forward, there is minimal emphasis on the means to achieve nexus policy and governance, for example, how to achieve greater policy cohesion, consistency, coordination, cooperation and collaboration and what is needed to implement the suggestions required for nexus governance to operationalise the nexus and therefore enhance capacity to better redress EWF security. Furthermore, other questions include: what are the barriers and what are the potential reasons for the existing separation and siloedness. Another limitation identified in the literature is that there is also a lack of a historical perspective which seeks to understand how the governance of EWF has evolved and the origins of such governance structures. These questions could be answered with a deeper understanding of the institutional dimensions of the EWF nexus. This would involve considering not only the types of institutional forms or structures that are needed but more importantly how such could come about, for example, what conditions are needed to facilitate nexus governance and what is needed to ensure nexus governance is useful in redressing EWF security.

Institutional dimensions within the EWF nexus are under-represented in the literature. The studies that do consider institutional dimensions, although helpful, are fragmented, with no unified way of understanding institutional dimensions in the context of the EWF nexus. The absence of a deeper understanding of the institutional dimensions of the EWF nexus prevents an understanding of concrete strategies to implement a nexus-based approach and a realisation of the policy

recommendations for dealing with current issues. There is a need for continued research in this field.

2.5 Conclusion

This chapter provided a literature review on the EWF nexus, divided into two main parts. The first part included a broad overview of the literature discussing the scale, scope and topics of investigation, analytical frameworks and methodologies and dimensions of the EWF nexus. The second part included a focused review on key studies that dealt with institutional dimensions of the EWF nexus. The mains points are listed below:

- The institutional dimensions of the EWF nexus are under-represented in the literature despite its importance in informing the overall direction for EWF nexus governance.
- The key studies were helpful and brought attention to a number of institutional issues. These are related to the complex governance systems characterised by multiple level governance across jurisdictions and value chains, siloed policy and a lack of coordination between actors across sectors. The studies furthermore emphasised the complexity of implementing a nexus approach. However, there were various angles and scales for which institutional dimensions could be analysed.
- Knowledge appeared to be fragmented, and there was no unified approach for examining institutional dimensions, particularly at a country level, where each EWF sector can be equally represented. Water tends to be the resource that receives the predominant attention. Studies mostly dealt with a narrow scope, mainly at a transboundary water scale. Others focussed on specific nexus linkages such as irrigation. Although Gain, Giupponi & Benson (2015) provide a country case study, their analysis is concentrated on policy integration with less discussion on the impact of laws and rule and actor networks, as illustrated in Stein et al. (2014).
- Further analysis of institutional dimensions could be useful to complement current knowledge about how to implement policies in terms of what conditions or structures are needed to support the success of policies, or in terms of the barriers to policy implementation.
- An analysis of institutional dimensions, which includes a historical analysis (which is also lacking in literature) could be useful to understand the potential reasons why EWF have been treated separately and in isolation. An understanding of these reasons can highlight the barriers to implementing a nexus approach as well as provide areas on which to focus for developing and formulating policies and strategies for EWF.

The next chapter develops a methodology for analysing institutional dimensions of the EWF nexus with the aim of better understanding the institutional factors shaping EWF policy to address EWF security.

Chapter 3 Institutional Theory and Approaches

The previous chapter reviewed the literature on the EWF nexus with a view to discuss the key focus of current research and to identify gaps in that research. One of the main limitations of current knowledge about the EWF nexus as seen in the literature is that there is an underrepresentation of the institutional dimensions of the nexus. These institutional dimensions are associated with understanding the overall approach for governing EWF, including an understanding of how policies, rules, organisations, government and the broader forces and processes (economic, political, social, cultural, environmental) that shape them, impact EWF.

The primary objective of this research is to develop an institutional perspective on the EWF nexus with the view to inform policy making to redress EWF security, thus contributing to filling the current gap in the literature on the EWF nexus. This chapter provides the theoretical background for developing the analytical framework of this research, based on institutional theory, to analyse the institutional dimensions of the EWF nexus in the context of EWF security.

The chapter is divided into five sections. Section 3.1 discusses the origins of institutional theory and the key concepts and characteristics, particularly with reference to the three main streams of institutional theory: *rational choice institutionalism*, *sociological institutionalism* and *historical institutionalism*. Section 3.2 discusses the definition of institutions, answering the following questions: what they are, what their purpose is, how they emerge, and how they change. Section 3.3 reviews studies that have analysed institutional dimensions, demonstrating the applicability of theory and types of insights an institutional analysis can provide, particularly for issues similar to EWF security. Section 3.4 discusses institutions in the context of EWF security and the Section 3.5 concludes the chapter.

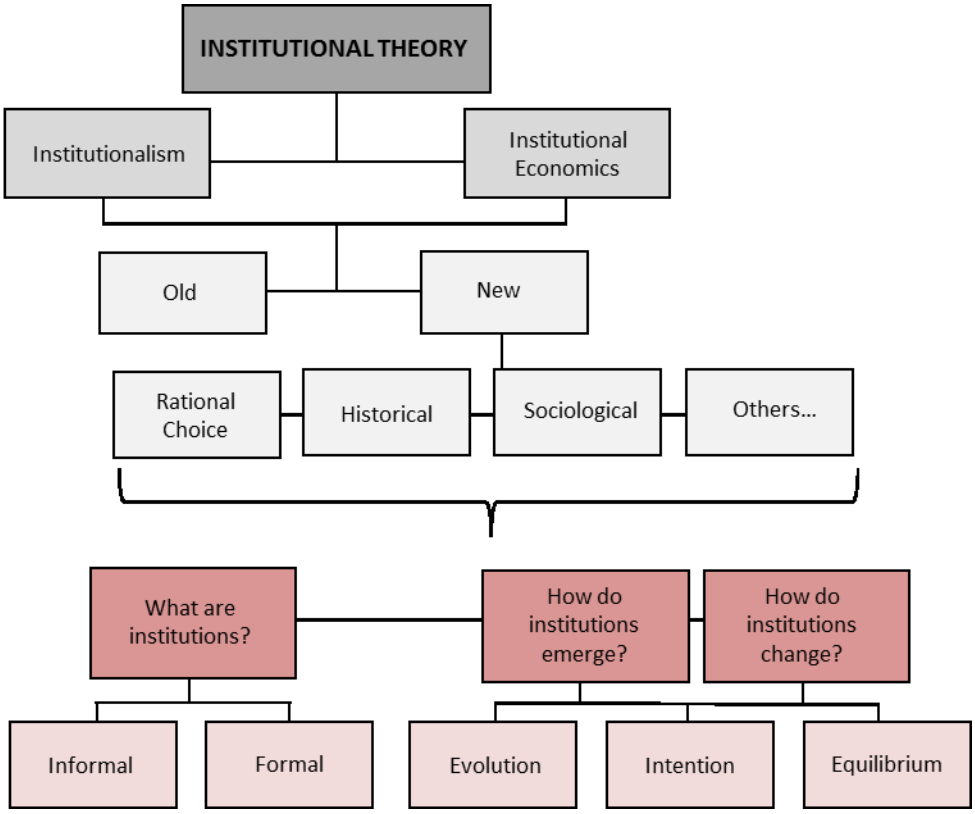
3.1 Origins of Institutional Theory

Institutional theory originated from the need to explore the socio-cultural, political and historical factors that shape certain social, political and economic behaviour and phenomena, which were factors under-theorised in mainstream social, political and economic analysis. It recognised the need for the then-existing approaches of analysis to incorporate these factors and account for the influences of the surrounding social structures and the broader context.

Institutional theory is a wide and diverse field that has been used in a variety of disciplines (economics, political sciences, organisational theory and social sciences). Definitions for

institutions, concepts and features vary across disciplines, schools and scholars. As a starting point, the study of institutions refers to the analysis of how 'something identified at a higher level is used to explain processes and outcomes at a lower level of analysis' (Amenta & Ramsey 2010, p. 15). Regardless of how institutions are precisely defined, this concept is common in all theoretical claims (Amenta & Ramsey 2010). Figure 3.1 presents an overview of institutional theory.

Figure 3.1: Institutional Theory



Source: Authors compilation

There are two dominant streams of institutional theory, *institutionalism* and *institutional economics*. *Institutionalism* is the study of institutions seen in organisational theory, political and social sciences. Examples include the work by authors Di Maggio and Powell, March and Olsen, Selznick, Ostrom, Shepsle, Greif, Hall and Taylor and others. *Institutional economics* is the application of institutional theory to the economics discipline, seen in the works by Veblen, Commons, Coase, Hodgson, North and Williamson and others. Both institutionalism and institutional economics have evolved to include old and new schools of thought, such as the *old institutionalism* and the *new institutionalism* as well as the *old institutional economics* and the *new institutional economics*.

3.1.1 Old and new schools of institutional theory

Institutional theory comprises of both old and new schools of institutional thinking in both institutionalism and institutional economics. The old institutionalism was associated with the study of formal institutions and in political sciences, according to Lowndes and Roberts (2013), it was the study of constitutions, organisational arrangements of representation, government, executive and legislatures, electoral systems, considered to be high-level formal influences on behaviour. Old institutionalism in political sciences was associated with 'describing and mapping the formal institutions of government and the modern state, both within specific countries and on a comparative basis' (Bell 2002, p. 3). Its focus was on 'charting the formal-legal and administrative arrangements of government and the public sector' (Bell 2002, pp. 3-4). It explained political behaviour as determined by 'formal rules or procedures' (Bell 2002, p. 4). New institutionalism sought to further explain political behaviour by taking into account, the informal conventions, that is, informal institutions in addition to formal institutions (Lowndes & Roberts 2013). New institutionalism recognised 'political behaviour and the sources of political power…derived primarily through informal relationships within and beyond the institutions of government' where the focus was on the 'socially embedded nature of pressure group politics, individual political behaviour and informal distributions of power' (Bell 2002, p. 4). The difference between the old and the new was the consideration of the informal aspects of political and social behaviour.

The emergence of new institutionalism was a result of criticisms by theorists about the 'atomistic conception of political life' (Shepsle 1989, p. 134), where individuals were studied without consideration of the broader context, seen particularly in rational-choice institutionalism (Lowndes 1996; Shepsle 1989). New institutionalism emphasised the importance of informal and formal forces in influencing behaviour. Emerging from the 1960s and 1970s (Hall & Taylor 1996), the new institutionalism included various strands of institutionalism including *historical institutionalism, sociological institutionalism, rational choice institutionalism, political institutionalism* and also *evolutionary institutionalism* (seen in Fürstenberg 2016), all questioning the reductionist approach to analysing behaviour.

Amenta and Ramsey (2010) reviewed historical, sociological and political institutionalisms in the context of politics. Historical institutionalism emerged as a response to rational choice theory and behaviourism, promoting the need to understand the processes 'behind the creation and the persistence of institutions and policies' (Amenta & Ramsey 2010, p. 16) and the influences at the state or political levels. Sociological institutionalism was a response to the 'neglect [of] cultural structures and processes' (2010, p. 16) in the explanation of behaviour. Political institutionalism focused on the differences between political institutions of different countries, looking at how

political processes and outcomes are influenced by the way in which states, political systems and political party systems are formed (Amenta & Ramsey 2010). The emergence of rational-choice institutionalism in the late 1970s was a response to the need to consider context in the analysis of individual behaviour that was concerned with optimising behaviour (Shepsle 1989).

Other comparisons of rational choice, sociological and historical institutionalisms are seen in Lowndes and Roberts (2013) and Hall and Taylor (1996) in the context of political sciences, Thelen (1999) who describes the differences between historical and rational choice institutionalism and Fürstenberg (2016) who discusses historical and rational choice strands and the emerging strand of 'evolutionary institutionalism'.

The application of institutional theory to the economics discipline developed into institutional economics, which similar to institutionalism in political sciences, emerged from criticisms of mainstream and orthodox economic thinking. Like institutionalism, theorists recognised the need to account for the wider social context. As Myrdal (1978) states,

> *the most fundamental thought that holds institutional economists together is our recognition that even if we focus attention on specific problems, our study must take into account the entire social system, including everything else of importance for what comes to happen in the economic field (p. 773).*

Mainstream economics was criticised for not taking into account the wider social system when analysing specific problems, focussing on only economic aspects and working with 'narrowly closed models, limiting the analysis to too few conditions' (Myrdal 1978, p. 775). The approach of institutional economics criticised neoclassical theory and its underlying and disputed assumptions, particularly of human behaviour regarding how individuals perceive the real world, their rational behaviour and their purpose for wealth and utility maximisation (Chavance 2008; Lowndes & Roberts 2013; North 1990). Neoclassical theory was believed to over-simplify human behaviour and hence, was considered inadequate for explaining behaviour.

Old institutional economists argued against the neoclassical theory, making the point that the economic processes that traditional economics assumed could be distorted by other social and political structures (Lowndes & Roberts 2013). Neoclassical theory remained concerned with the market, the notion of equilibrium and the rational, calculating and utilitarian actions of individuals to deliver efficiencies (Chavance 2008). It paid little attention towards the role of institutions, ideas and ideologies and the complexity of human behaviour which was described as 'preventing economists from coming to grips with fundamental issues (North 1990, p. 17).

Old institutional economic theory was critical of orthodox economic thinking but was, in turn, criticised for not providing substantial theory (Hodgson 1998; Rutherford 2000). It was considered as 'little more than a tradition of dissent, with no positive program of its own' (Rutherford 2000, p. 289). Although old institutional economists challenged neoclassical theory, they could not provide theory that could replace it. Hence, new institutional economics emerged.

New institutional economics instead was developed to build on and extend neoclassical theory (North 1995) rather than seeking to replace it, as old institutional economics attempted to do. New institutional economics accepted the core assumptions of mainstream economics (Hodgson 1993; Lowndes & Roberts 2013) such as utility maximising behaviour and accepted individuals to act rationally but also considered the broader influences. It recognised that the individual was influenced by its surroundings and that its behaviour was influenced by habits and social rules (Hodgson 1993). The concept of habits and rules was central to understanding behaviour as promoted by Veblen (Hodgson 1998) and it emphasised that the individual should not be taken for granted, as taken for granted in mainstream economic thinking. New institutional economics enabled an approach that could make a compromise between institutional theory and economic theory. New institutional economists settled with having individuals as the starting point of analysis, unlike old institutional economists that struggled to decide between the individual and environment (Hodgson 1993).

The traditional economic theory that assumed that individuals possessed true models of the world, had perfect information and experienced zero costs of transaction for all exchanges was particularly problematic. North (1991) argued that the models that individuals possessed were, on the contrary, subjectively derived and varied such that the information that individuals have to use to engage in exchanges and make decisions was often incomplete. Also, due to differences in the mental capacities of individuals to process information, information asymmetries exist, introducing uncertainty in exchanges.

Asymmetric information and differences in mental capacity produce exchange costs or transaction costs, which is an important concept as these transactions costs, comprising the 'effort, time and expense involved in obtaining the information necessary to negotiate, make and enforce an exchange' (Williamson 1985 cited in Saleth & Dinar 2004, p. 52) prevent exchanges from occurring in the way that traditional economic theory assumed. Exchanges could result in sub-optimal, costly and inefficient outcomes. This complexity associated with human behaviour and individual cognitive systems to process information in order to solve problems, make decisions and engage in exchanges, and the existence of transaction costs is what institutional economists, such as North explained, gives rise to the need for other structuring forces that is, the need for

institutions. New institutionalists saw institutions as needed to resolve or minimise transaction costs.

In sum, institutional theory, regardless of whether from old or new school, acknowledges that institutions matter. Whether they are defined broadly as referring to high-level forces that are either formal or informal or social contexts or social structures that influence behaviour of the individual, institutional theorists challenged mainstream economic analysis that was based on reductionist approaches that analysed behaviour as being removed and independent from context and social environment. The theory promoted the understanding of broader forces that influence behaviour. As Granovetter (1985) stated, 'behaviour and institutions… are so constrained by ongoing social relations that to construe them as independent is a grievous misunderstanding' (p. 504). The author argued that 'most behaviour is closely embedded in networks of interpersonal relations…' (1985, p. 504).

3.2 Institutions - Characteristics and core concepts

In order to develop an institutional perspective on the EWF nexus, it is necessary to understand the key features and core concepts of institutional theory and how they are relevant to EWF security. The various schools and strands of institutional theory reflect different perspectives on what institutions are, what institutions do, how institutions emerge and how institutions change. Given the various perspectives, it is challenging to define institutions, as there is no unified definition or theory and there is 'little agreement on what the term institutions means' (Ostrom 1986, p. 4). This section discusses the key characteristics of institutions, discussing different perspectives from the institutional strands and comparing the concepts in each to identify and define institutions in the context of the EWF nexus.

3.2.1 Defining institutions - What are institutions and what do they do?

As mentioned, the common theme behind institutional analysis is the recognition that there are higher-level influences that explain outcomes at lower levels. The main purpose or characteristic of institutions is that institutions structure behaviour. They do so either formally via law, regulation or rules or informally via social norms, moral values, customs, ideologies, routines (North 1990). Although there are various definitions for institutions, they are generally defined as constraints, and they are also considered to constitute human behaviour (Hodgson 1998). To simplify the understanding of key concepts, Hall and Taylor (1996) describe two approaches of institutionalism: the *calculus* and the *cultural* approach. Each approach can be used to characterise each institutionalism strand, both providing distinct views on the nature of individual behaviour.

The *calculus* approach focuses on the instrumental, strategic and calculative behaviour of individuals, assuming behaviour is based on optimisation and utility maximisation. This approach tends to be utilised by rational choice institutionalists. In the calculus approach, institutions have a constraining function to shape behaviour through specific patterns that allow individuals to predict with a degree of certainty the actions of others in various situations. The importance of this is that it enables individuals to act accordingly to better meet their personal objectives given the expectations they may have of how others will act. Institutions assist in enabling individuals to obtain their most desired outcomes, such as greater gains from an exchange or problem interaction. In this way, individuals are unlikely to deviate from such patterns of behaviour as they will be worse off and as individuals follow such patterns, the more enduring institutions become (Hall & Taylor 1996, pp. 939-940).

The *cultural* approach, on the other hand, views the individual as not purely strategic but reliant on routines and patterns of behaviour. Rather than having optimising behaviour, like the individual concerned in the calculus approach, the individual acts according to how the individual interprets the world around them. The individual interprets the world based on an understanding of symbols, scripts and routines and these form institutions which provide the individual with filters which the individual can use to understand its surroundings to be able to act accordingly (Hall & Taylor 1996). Individuals are considered as satisficers rather than utility maximisers (Hall & Taylor 1996).

Both approaches define distinct assumptions of individuals and institutions. The calculus approach is mostly associated with the *rational choice* strand and the cultural approach is mostly associated with the *sociological strand*, but both can be applied to the *historical strand* of institutionalism. Table 3.1 (adapted from Hall and Taylor (1996, pp. 939-940) summarises the elements of the calculus approach and the cultural approach.

Rational choice institutionalism adopts a calculus approach to institutional theory in assuming rational and utility-maximising behaviour but accepts how context and rules define optimising behaviour, differing from rational choice theory (Shepsle 1989). Rational choice institutionalists define institutions as 'human constructions designed to solve collective action problems to maximise gains from cooperation' (Lowndes 2002, p. 67), in use only when they serve the interests of actors.

Table 3.1: Calculus vs. cultural approach to institutional analysis

	Calculus Approach	Cultural Approach
Individuals	• Instrumental and strategic • Optimisation and utility-maximisers behaviour	• Rely on routines and patterns of behaviour to attain their purposes • 'Satisficers'
Institutions	• Provide actors with greater or lesser degrees of certainty about the behaviour of others • Alter the expectations an individual has about the actions that others are likely to take in response to or simultaneously with his or her own action • Deviation from certain behaviour will make the individual worse off • Robust the more an institution contributes to the resolution of collection action dilemmas or greater gains from exchange	• Provide moral or cognitive templates for interpretation and action • Affect the identities, self-images and preferences of actors • Institutions cannot be readily transformed by the actions of any one individual • Resistant to redesign as they influence choices about reform

Source: adapted from Hall and Taylor (1996, pp. 939-940)

Institutions guide human interaction by providing structures to simplify exchange processes, allowing individuals to determine or estimate possible outcomes (North 1990). Institutions allow individuals to deal with complex exchange situations that result from asymmetric information and the different capabilities of individuals to processes information, helping to minimise the associated transaction costs (Hall & Taylor 1996), reducing conflicts and improving cooperation within society (Mantzavinos 2001; Rutherford 1983; Thelen 1999).

As North (1990) described, institutions shape behaviour because they define 'what individuals are prohibited from doing and under what conditions individuals are permitted to undertake certain activities' (p. 4). They shape behaviour by providing incentives for individuals (North 1990). This is similar to Ostrom's (1986) definition of institutions as rules that prescribe 'which actions are required, prohibited or permitted' (p. 5).

For Ostrom (1986), institutions refer to what is 'commonly known and used…to order repetitive interdependent relationships' (p. 5). Institutions emerge to solve problems that are repetitive in nature to achieve regularity (North 1986). They must also be enduring (Crawford & Ostrom 1995). In achieving regularity, a necessary requirement is that individuals must agree on and accept institutions as rules in order to be effective as institutions. Individuals agree on and comply with institutions in order to avoid having to decide each time on an action when conflict arises (Lowndes 2002; Mantzavinos 2001). Chavance (2008) cited Aoki (2000) and reinforced this point, maintaining that an institution exists only if 'agents collectively believe in it' (p. 56).

Individuals 'classify the same set of problems as old ones and follow the same routines' (Mantzavinos 2001, p. 88). For example, this can be seen formalised in the notion of legal precedence, which the courts use to render decisions based upon previous interpretations of the law. The predictability that institutions enable between individuals in understanding one's behaviour allows institutions to be enduring. Individuals agree on and accept institutions, as they assist them in minimising conflicts and solving problems. They structure exchange to enhance predictability and lower uncertainty (North 1990). Rational choice institutionalism recognises institutions in shaping the instrumental behaviour of individuals in their pursuit of utility maximisation. (Hall & Taylor 1996). For rational choice institutionalists, institutions play a role in laying down the rules for optimising behaviour.

On the other side of the spectrum is *sociological institutionalism* which adopts a cultural approach to institutional theory. Sociological institutionalism originated from organisational theory, which focused on the structures, forms and procedures within organisations associated with enabling their efficiency. The sociological institutionalists proposed, however, that these forms were not a result of efficiency, which was emphasised in rational choice theories, but were a result of other culturally specific and influenced practices.(Hall & Taylor 1996).

Sociological institutionalists 'seek explanations for why organisations take on specific sets of institutional forms, procedures or symbols and emphasise how such practices are diffused' (Hall & Taylor 1996, p. 947). They focus on 'processes of imitation and diffusion and…convergences in…institutions and policies' (Amenta & Ramsey 2010, p. 16), looking at the state, meso or organisational level. For example, DiMaggio and Powell (1983) looked at isomorphic processes by which organisations change, grouped into coercive, mimetic and normative processes, and March and Olsen (1984) studied the influence of organisations in political life.

Sociological institutions emphasise the role of culture in influencing behaviour. In sociological institutionalism, institutions refer to 'symbol systems, cognitive scripts, and moral templates that provide the "frames of meaning" that guide human action' (Hall & Taylor 1996, p. 947). According to Campbell (1998), individuals act based on cognitive frameworks involving routines, habits, rituals, scripts and cues that enable them to deal with uncertainty. They also shape appropriate forms of political organisation, policy goals and policy instruments.

One approach for sociological institutionalists, according to March and Olsen (2013), involves understanding actors as following norms and conventions based on the logic of appropriateness where 'action is driven by rules of appropriate or exemplary behaviour, organised into institutions' (p. 689). The authors state that 'rules are followed because they are seen as natural, rightful, expected and legitimate' (p. 689). Individuals are seen to 'fulfil obligations encapsulated in a role' (March & Olsen 2013, p. 689). In contrast to rational choice models, individuals act

according to what they deem as appropriate, not necessarily according to cost minimisation or efficiency criteria. Cultural authority also plays a significant role in defining legitimacy and social appropriateness (Hall & Taylor 1996).

Historical institutionalism draws upon both calculus and cultural approaches. Historical institutionalists see institutions as the 'formal and informal procedures, routines, norms and conventions embedded in the organisational structure of the policy or political economy' (Hall & Taylor 1996, p. 938). Their emphasis is on how institutions evolve.

Definitions of institutions

North (1990) defined institutions as 'the rules of the game in a society or more formally,…the humanly devised constraints that shape human interaction' (p.1) in areas political, economic and social. Accordingly, they structure social behaviour to reduce uncertainty. While there are many definitions of institutions, North's interpretation of institutions shares similarities with other definitions. For example, Crawford and Ostrom (1995) define institutions as 'rules, norms and shared strategies which are constituted and reconstituted by human interaction in frequently occurring or repetitive situations' (p. 58). Nabli and Nugent (1989) furthermore defined institutions as a 'set of constraints, which governs the behavioural relations among individuals or groups' (p. 1334). The similarity between each definition is the recognition of shared norms, rules and constraints amongst individuals. One of the most important characteristics of institutions, accepted by scholars, is that they constrain and shape behaviour. According to Nabli and Nugent (1989), there are three characteristics, which are basic to the concept of institutions. First is the rules and constraints nature of institutions and how they are put together, second is their ability to govern the relations among individuals and groups and third, is their predictability and stability, that rules must be understood and applied. Table 3.2 lists several definitions of institutions.

Table 3.2: Definitions of Institutions

Author	Definition
Amenta and Ramsey (2010)	'…higher order factors above the individual level influence political processes and outcomes and tend to produce regular patterns of stasis' (p. 32)
Aoki (2007)	'…self-sustaining, salient patterns of social interactions, as represented by meaningful rules that every agent knows and are incorporated as agents' shared beliefs about how the game is played and to be played' (p. 6)
Clemens and Cook (1999)	'Institutions are predominantly associated with the constitutive role of culturally legitimate models of organisation and action' (p. 442) Institutions are seen as 'constraining or constitutive, as operating through regulative, normative, or cognitive mechanisms: Institutions exert patterned higher-order effects on the actions, indeed the constitution, of individuals and organizations without requiring

Author	Definition
	repeated collective mobilization or authoritative intervention to achieve these regularities' (Clemens & Cook 1999, pp. 444-445 cites Jepperson 1991)
Coase (1998)	Institutions of the country including: 'its legal system, political system and its social system, its education system and its culture system and so on'. They have a role in influencing the costs of exchange (transaction cost). Costs of exchange limit productivity of the economic system thus limiting the welfare of human society which depends on the flow of goods and services (p. 73)
Crawford and Ostrom (1995)	'...enduring regularities of human action in situations structured by rules, norms, and shared strategies as well as by the physical world The rules, norms and shared strategies constituted and reconstituted by human interaction in frequently occurring or repetitive situations. (p. 582)
Greif (1998)	'…non-technologically determined constraints that influence social interactions and provide incentives to maintain regularities of behaviour' (p. 80)
Hodgson (2006)	'… systems of established and prevalent social rules that structure social interaction, e.g. language, money, law, systems of weights and measures, table manners and firms (and other organisations) are thus all institutions' (p. 2)
Nabli and Nugent (1989)	'…set of constraints, which governs the behavioural relations among individuals or groups' (p. 1334)
North (1986, 1990, 1991)	'Institutions are regularities in repetitive interactions among individuals'. Institutions are customs and rules' (North 1986, p. 231) '…the rules of the game and more formally the humanly devised constraints that shape human interaction' in areas, political, economic and social (1990, p. 3; 1991, p. 97).
Ostrom (1986)	'…rules' that 'refer to prescriptions commonly known and used by a set of participants to order repetitive, interdependent relationships. Prescriptions refer to which actions (or states of the world) are required, prohibited or permitted' (p. 5)
Williamson (2000)	Institutions comprise 'institutional environment' and 'institutional governance or arrangement'. The former refers to the rules of the game (the polity, judiciary, laws of contract and property) and the institutions of governance refers to the play of the game (the use of markets, hybrids, firms, bureaus)
Fürstenberg (2016)	'…rule that determines a form or function. An institution, therefore, can be a rule determining the number of members in a parliament or a rule determining who in parliament is eligible to be elected to the position of speaker. Based on that definition, an institutional arrangement would imply a number of institutions linked together by meaning or purpose' (p. 47)

Having provided a set of definitions for institutions, it is important to distinguish between institutions, understood as rules and constraints as distinct from organisations, defined as 'groups of individuals bound by a common purpose to achieve objectives' (North 1990, p. 5). North describes organisations as the players of the game while institutions are the rules of the game.

They include political bodies, (parties, the Senate, a city council, a regulatory agency), economic bodies (firms, trade unions, family farms and cooperatives), social bodies (churches, clubs) and educational bodies (schools, universities, vocational training problems) (North 1990). Organisations and institutions are connected. While institutions influence the types of organisations which come into existence and how they evolve by creating incentives for organisations to form, organisations also influence institutions because as organisations evolve, they may also induce changes in institutions. Hence, there is a feedback process between institutions and organisations.

An important feature of institutions is also the provision of social order. Institutions exist because there is a need to solve social problems and overcome social conflict, particularly when individuals pursue self-interested activities that may cause harm, lead to conflict with another or cause disorder. By structuring interaction, institutions govern social behaviour and hence provide a form of social control for cooperation (Mantzavinos 2001). Social order is important because it influences how society lives safely and protects people's wellbeing, how members of society ensure their livelihoods and also how society achieves its goals. Where there is a demand for social order, institutions and their enforcement characteristics (enforcement of the law or other mechanisms of social control) are required to play a role in achieving order (Mantzavinos 2001).

Informal and formal institutions

Institutions include informal and formal constraints that shape behaviour, structure interaction and provide social order. Informal constraints are those that include values, belief systems and cultural norms and will be referred to as informal institutions. Formal constraints refer to formalised rules such as legislation and contracts and will be referred to as formal institutions.

Informal institutions

Examples of informal institutions include social norms, values, traditions, customs, conventions, religious beliefs, moral rules and codes. North (1990) described informal institutions as being derived from culture which provides a framework through which individuals can interpret information and perceive the world around them. According to Pejovich (1999), informal institutions are part of a community's heritage. They 'embody the community's prevailing perceptions about the world, the accumulated wisdom of the past and the current set of values…[and]…are maintained from one generation to another through various transmission mechanisms such as imitation, oral tradition and teaching' (Pejovich 1999, p. 166). They shape the development of societies through their lasting presence (North 1990). These prevailing cultural values and norms form the social relations and patterns between individuals and groups (Mantzavinos 2001).

Mantzavinos (2001) highlights three types of institutional constraints: *conventions, morals* and *social norms*. Conventions are those social rules that solve social problems of coordination in which there is no incentive for an individual not to conform. Conforming to conventions is expected and preferred. An individual cannot improve his or her situation if he or she chooses to deviate from the conventions. An example of a convention is provided by the first in first out rules. Moral rules are also solutions to social problems but reflect a certain socially beneficial type of behaviour. Examples include such rules as those that require one 'to keep promises, to not cheat, to respect other people's property' (Mantzavinos 2001, p. 106). While moral rules exist in many societies, they may not necessarily be followed. Mantzavinos noted that often, moral rules are conditional such that an individual may be willing to cooperate only if the rest cooperate. Social norms, on the other hand, are solutions to social problems 'where conflicting individual interests prevail' (Mantzavinos 2001, p. 118). Social norms are meant to regulate otherwise, specific and certain situations. The need for a norm arises when internalising the external effects of individuals' actions is extremely difficult and particularly when external effects impact several individuals. Axelrod (1986) stated that 'a norm exists in a given social setting to the extent that individuals usually act in a certain way and are often punished when seen not to be acting in this way' (p. 1097). Enforcement of these informal constraints can include sanctions, such as expulsion from the community, ostracism, or loss of reputation (Pejovich 1999). Otherwise, informal institutions can be self-policing and self-enforcing.

While informal institutions are important for social order, they are not necessarily sufficient to provide order. Mantzavinos (2001) made the point that it is often not viable to have stateless societies in which societies are ordered solely by informal institutions. Rising populations of societies that are more impersonal and increasing complexity within groups give rise to the need for formal institutions.

Formal institutions

Informal institutions are often insufficient to deal with complex disputes and social problems and therefore, they are insufficient to produce social order (Mantzavinos 2001). When different individuals lack common mental models, lack a common understanding of each other and possess different morals and values, the potential for social conflict increases, and this gives rise to the need for formal institutions and enforcement. Formal institutions include laws, regulations, constitutions, statutes, contracts and market rules. They can include 'political and judicial rules, economic rules and contracts' (North 1990, p. 47) and can be considered to be in a hierarchy – from constitutions, statutes, to common laws to specific bylaws and finally to individual contracts. These formal rules define constraints from general rules to particular specifications, and each type of formal rule varies in costliness to alter.

Formal rules entail compliance costs, and this implies the need to determine whether rules are broken, to what extent have they been broken and how rule breakers should be punished (North 1990). Formal rules are enforced by a third party, which is often the state. Mantzavinos (2001) explained that the state exists to provide a solution to the 'problem of trust and protection from the aggression of individuals of the same society and those of different societies' (p. 133). The state has a role to enforce institutions to maintain social order, and in particular, it has a role in enforcing property rights (Mantzavinos 2001). Legal rules, defining the rights of individuals, are also formal rules that are enforceable by the state.

The distinction between informal and formal institutions is common in understanding institutions reflecting both the informal and formal means of shaping social behaviour. A similar distinction between the types of institutions is provided by Cleaver (2002, p. 13). Rather than using formal and informal institutions, the author used the terms bureaucratic and socially embedded to classify institutions where bureaucratic institutions are 'formalised arrangements based on explicit organisational structures, contracts and legal rights, often introduced by governments or development agencies' (p. 13). Socially embedded institutions are those which are based on 'culture, social organisation and daily practice' (Cleaver 2002, p. 13). Cleaver (2002) however argued that both may not be distinguishable and that it is also possible that bureaucratic institutions may be socially embedded and that socially embedded institutions such as culture or traditions may also be bureaucratised. Lowndes and Roberts (2013) differentiate informal and formal institutions as written or non-written rules.

Relationship between informal and formal institutions

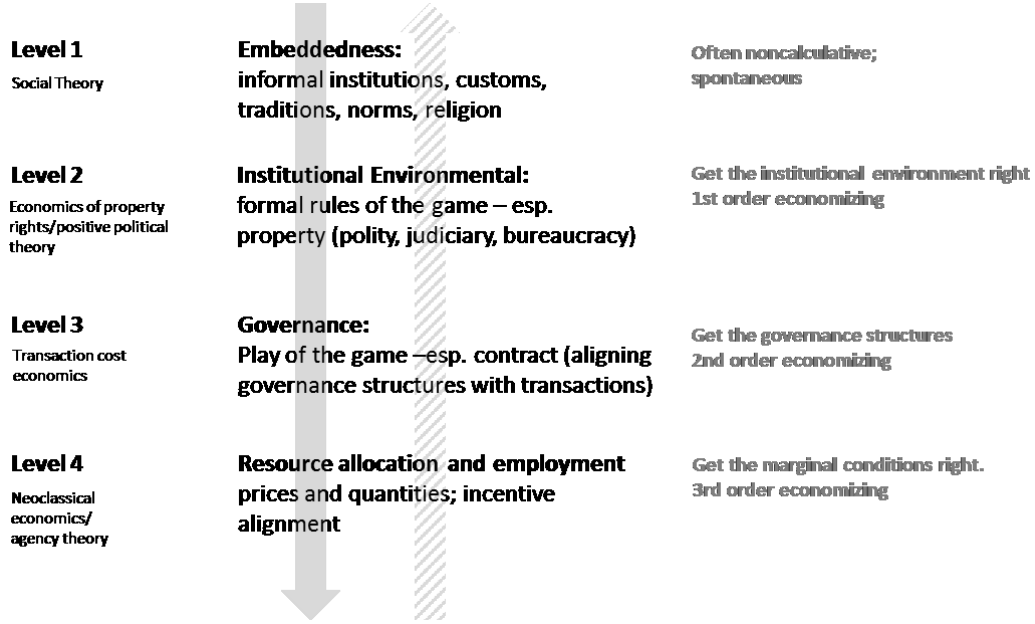
Four levels of institutions

The differences between informal and formal institutions are captured in Williamson's framework (2000) which considers four levels of social analysis. Level 1, the top level, is the *embeddedness* level. This level includes informal institutions: customs, traditions, norms and religions. Institutions at this level evolve over a very long period and do not change easily. Williamson (2000) described these informal institutions as having 'a lasting grip on the way society conducts itself' (p. 597). Level 2 is the *institutional environment*. This level includes the formal rules of the game (polity, judiciary, bureaucracy). Williamson (2000) described this level as being concerned with 'getting the formal rules of the game right' (p. 598). The instruments at Level 2 include the executive, legislative, judicial and bureaucratic functions of government as well as the distribution of powers across different levels of government (federalism). The definition and enforcement of property rights and contract laws are important features. The legal system defines the rights and arbitrates disputes. The next level, Level 3, is the *governance* level. This level looks at the play of the game where the governance of contractual relations is the focus. This level is

concerned with aligning governance structures with transactions, considered as institutional arrangements. Lastly, Level 4 is concerned with *resource allocation and employment*, looking at prices and quantities and incentive alignment.

The four levels are connected. Higher levels impose constraints on the levels below and lower levels connect to higher levels through signalling feedback (Williamson 2000). For example, all informal institutions impose constraints on the formal rules of the game and the way it is played. The framework provided by Williamson (2000), however, depicts the levels of institutions in the context of the new institutional economics. Figure 3.2 illustrates Williamson's framework (Williamson 2000, p. 597).

Figure 3.2: Levels of Social Analysis



Source: Williamson (2000, p. 597)

Despite such distinctions, both informal and formal institutions interact and the relationship between different institutions will have implications on the outcomes of rules. Pejovich (1999) discussed several relationships that occur between informal and formal institutions. First, the author argued that formal institutions can suppress but cannot change informal institutions. The author used the example of the rise of ghettos in America, where individuals of similar ethnic and racial backgrounds, despite living under the same formal rules, still maintain their respective cultures and choose to stay close to those whose behaviour they can understand and predict. Secondly, the author argued that formal rules are often in direct conflict with informal rules. The author described how the Russian Orthodox Church used the legal system to protect the Russian Orthodox Church from competition by other churches and others with different religious views.

The author furthermore discusses that formal rules can also be ignored, and this happens when the costs of depending on informal arrangements are cheaper than those of formal rules to resolve problems. For instance, individuals may choose to settle conflicts on their own, without going to court or seeking a formal mediation. The ideal situation however, is to have harmony between formal and informal rules as this will enable lower transactions costs. Conflict between formal and informal rules is likely to raise transaction costs (Pejovich 1999).

Both formal and informal institutions have an important role in structuring and shaping behaviour at individual, social, economic and political levels. The interaction between the two types of institutions and their enforcement characteristics, however, influences the degree to which they constrain behaviour. As previously mentioned, informal institutions are generally self-policing whereas formal institutions are enforced by a third party, for example, the state. When informal institutions are not sufficient to constrain society and maintain order, formal institutions are required and needed when conflict persists. Informal and formal institutions can either complement each other or conflict.

3.2.2 Development and emergence - How do institutions develop and emerge?

There are various explanations for how institutions develop and emerge. Old institutional economics struggled with understanding the emergence of institutions. On the one hand, institutions were believed to emerge from individual action, but it was also believed that in order for interaction, institutions must already exist. New institutional economics overcame this by starting with the individual as the 'elemental building block' for analysis (Hodgson 1993, p. 5). Explanations for the emergence of institutions range from emphasis on human creation for instrumental purposes to the spontaneous emergence of institutions through evolutionary processes.

North (1990; 1991) emphasised the human creation aspect of institutions, describing the need to impose constraints for, as discussed, resolving conflicts and minimising problems associated with individuals pursuing self-interested activities that might lead to harm. Institutions are created with a purpose to prevent negative outcomes by governing behaviour, furthermore, maintaining social order. In doing so, institutions provide the conditions for which individuals, groups and societies can meet their goals. For Saleth and Dinar (2004), the overall purpose of institutions in structuring socio-economic behaviour is to achieve certain outcomes, either a human purpose or a goal or to address a human concern. In this view, institutions are a means to an end.

Rational choice institutionalists place an emphasis on understanding where institutions come from, using individuals as a starting point (Thelen 1999). Institutions emerge as a result of

interaction between individuals and learning processes (North 1990). At a more specific level, Mantzavinos, North and Shariq (2004) highlight the development of mental models. The authors view institutions from an internal point of view as the 'shared mental models or shared solutions to current problems of social interaction' (p. 77) and from an external view as the 'shared behavioural regularities or shared routines within a population' (p. 77). These shared mental models and shared behavioural regularities develop from the learning processes of the mind. As the mind sorts and interprets the experiences from the physical and social environment, individuals develop mental models (Mantzavinos, North & Shariq 2004). Mental models reflect the final expectations the mind makes up about the environment. Learning processes reflect the processes by which mental models, expectations or predictions about the environment change according to environmental feedback. These mental models change in order to find better solutions to problems, and they evolve through a trial and error process. The authors describe that once these mental models are stabilised, they become beliefs and these beliefs about the environment guide individuals to solve their problems and survive in their environment (Mantzavinos, North & Shariq 2004). In sum, institutions are created when learning processes that start at an individual level, take place at the society level, when mental models are developed and shared collectively. Institutions emerge from a learning process that takes place within and between individuals who interact and experience the environment. Constraints are developed from these processes to ensure appropriate solutions, responses, social interaction and behaviour.

The emergence of institutions was mostly discussed thus far as coming from the process of interaction between individuals to develop shared mental models to solve problems. However, as Mantzavinos (2001) states, as well as emerging spontaneously through interaction, they can also emerge deliberately as 'a product of collective actions' (p. 90).

In terms of emergence and change, sociological institutionalists, like historical institutionalists, consider institutions to develop, emerge, change or be adopted 'in a world already replete with institutions' (Hall & Taylor 1996, p. 953). They analyse how institutions are created in a world with already existing institutions. Unlike rational choice institutionalism, the starting point is not the individual and the need to solve coordination problems. Institutional theory here 'traces the emergence of distinctive forms, processes, strategies, outlooks, and competences as they emerge from patterns of organisational interaction and adaptation' (Selznick 1996, p. 271). Sociological institutionalists emphasise the concept of *institutionalization* defined as 'the emergence of orderly, stable, socially integrating patterns of unstable, loosely organized or narrowly technical activities' (Selznick 1996 cites Broom and Selznick 1955, p. 238). Institutions can also be developed from processes of imitation, adaptation and the re-use of existing institutions for other purposes (Lowndes & Roberts 2013).

Historical institutionalists focus on how 'institutions emerge from, and are embedded in, concrete temporal processes' (Thelen 1999, p. 371) and how institutions affect the behaviour of individuals rather than how individuals create institutions (Thelen 1999). In terms of how institutions originate, emerge or change, historical institutionalists emphasise path dependency which shapes development in certain ways and how different countries respond to different challenges (Hall & Taylor 1996). Historical institutionalists argue that the effects of institutions are determined by factors from the past. As future paths are conditioned by the past, it is very difficult to change the course of direction. It is argued that institutions follow a path-dependent process, whereby 'small events and chance circumstances can determine solutions that once they prevail lead to one particular path' (North 1990, p. 94). North (1991) saw institutions as 'connecting the past with the present and the future' (p. 97) and views history and economic performance over time as a 'story of institutional evolution' (p. 97). History plays an important role in shaping institutions and the effects of institutions, and this can explain the differences in the way institutions shape behaviour in different contexts. The outcomes of similar rules and constraints can differ according to context based on different histories (Hall & Taylor 1996).

3.2.3 Institutional change – How do institutions change?

While 'stability is a defining feature of institutions' (Lowndes 2002, p. 104), institutions do not remain static. Institutions, once they emerge, may change and evolve. Institutional change is an important feature in the study of institutions because of the impacts that institutional change has on shaping behaviour, structuring social interaction and in allowing societies to deal with the new challenges posed by their changing wider economic, political and social context.

Institutional change theories are closely related to how institutions emerge. Institutions may change as a result of deliberate actions to create new institutions or alter existing ones or as a result of the constant evolution of institutions. Goodin (1996) discussed three ways institutions both arise and change, firstly, by accident; secondly, by evolution including processes that see better forms of institutions that outlast those that are inferior, or where some better forms outlast inferior forms; and thirdly, institutions may change by the design and intentional intervention by actors.

The speed and frequency of institutional change varies according to the type of institutions. While most informal institutions change slowly and gradually, formal institutions, other than constitutions, can change reasonably quickly; for instance, policies can be changed or amended overnight. Lowndes and Roberts (2013) found that institutional change is context dependent, and that 'institutions change over time through processes of recombination, through the articulation of old and new institutional elements and shifts in the configuration of rules, practices and

narratives' (p. 202). Institutional change can however, be gradual and progressive (Chavance 2008). According to Imperial (1999) most institutional change appears to be 'dependent and incremental rather than totally reconstructive or destructive' (Imperial 1999, p. 460).

Kingston and Caballero (2009) discussed three theories of institutional change, namely, 1) *collective choice theory,* 2) *evolutionary theory* and 3) *equilibrium theory*. These are described as follows.

Collective Choice theory is one such theory of institutional change, characterised by the centralisation of rules, where rules are 'specified by a collective entity' (Kingston & Caballero 2009, p. 4). In order to change rules, such entities 'engage in collective action, conflict and bargaining to try to change rules' (Kingston & Caballero 2009, p. 4). According to Mantzavinos (2001) change occurs is when 'change is initiated by individuals acting collectively to respond to a new social problem' (p. 95). Such institutional change occurs when individuals choose to change the formal rules 'motivating actors to adopt different strategies and behaviours' (Imperial 1999, p. 460).

Institutional change take place whenever one or more agents think that their interests are better served under a new institutional arrangement than the prevailing one (Mantzavinos 2001). Rational theorists believe that actors will only change institutions when the likely benefits outweigh the expected costs of changing institutions (Lowndes 2002). These costs will include the costs of learning how to operate within a new structure or dealing with new sources of uncertainty and of engaging in exchange (Lowndes 2002, p. 105 cites Rothstein 1996, p. 152). This is in line with theories of transaction cost economics that assumes that the most efficient institutional forms, those that minimise transactions costs, will emerge.

Kingston and Caballero (2009) state that different institutional configurations 'entail different distributional consequences' (pp. 4-5), and that individuals and groups will engage in bargaining, lobbying and political action to try to alter the rules for their own benefit. As some groups bargain to alter rules, change however may not take place. Institutional change can be hindered by groups who have a vested interest in preserving the status quo, as defined by the existing institutions. If groups protecting the status quo succeed in resisting institutional change, this may however, lead to the persistence of inefficient institutions. When change does involve conflicting groups, large changes to rules are unlikely. Changes instead will take place incrementally through small changes where consensus is easier to achieve.

Lowndes (2002) discussed how institutions constantly evolve and vary, noting that 'there is always ambiguity in interpreting and in the application of rules' (p. 69). Rules are adapted by actors seeking to make sense of their changing environments (Lowndes 2002). Institutions change, particularly from the perspective of sociological institutionalists, through evolutional

processes as described in Kingston and Caballero (2009). In contrast to collective action theories, in evolutionary theories there is 'no central mechanism that causes a coordinated shift in the rules perceived by all the players' (Kingston & Caballero 2009, p. 4). In this theory, new institutions, beliefs and norms emerge and, as the authors describe, they go through a process where successful institutions spread and where unsuccessful institutions die out. Change is brought about and 'diffused in an evolutionary process' (Mantzavinos 2001, p. 95). Such theory reflects the trial and error learning processes that allow mental models to evolve.

Historical institutionalists, emphasise the evolving nature of institutions particularly of path dependency suggesting that past factors shape future outcomes. Historical institutionalists, however, do not assume that institutions evolve to become the most efficient institutions or the most desirable institutions (North 1990). As mentioned, inefficient institutions may continue to exist if society or specific groups continue to support them. The nature of path-dependence can contribute to the persistence of inefficient institutions.

The path-dependent process of institutional change is further influenced by the degree of cultural change that sets the pace with which institutions change. Those who share similar cultural beliefs tend to live in particular ways, and as cultural beliefs are transmitted across generations, they become inbuilt and inflexible. This creates cultural inertia.

Mantzavinos, North and Shariq (2004) state that when 'shared learning is the same or similar over a number of periods [such] mental models become inflexible' (p. 81) and the shared belief systems that develop are difficult to alter. Mantzavinos, North and Shariq (2004) refer to this as cognitive path dependence where mental models become difficult to change. The authors describe that as shared mental models continue to solve certain problems, this will lead to further institutional path-dependence.

The concept of critical junctures, seen in Acemoglu and Robinson's (2012) account of economic development that explained the importance of institutions in influencing the success of some economies compared with others, is used to explain how pathways, however, may change, leading development down an alternative trajectory. Economic development and growth is attributed to certain characteristics of the economic and political systems pertaining to different countries with regard to adapting to changing environments and creating conditions that foster and facilitate development rather than hinder it.

The third theory which is explained by Kingston and Caballero (2009) is the 'equilibrium theory of change' (p. 17). This sees the role of institutions, both formal and informal as coordinating individuals to achieve different equilibria based on shared set of beliefs about behaviour. Thelen (1999) stated that rational choice institutionalists focus on 'coordinating functions of institutions that continue generating and maintaining equilibria' (p. 371). For Shepsle (1989), the focus is on

structure-induced equilibrium, which refers to 'the equilibrium in outcomes produced by a specific institutional configuration' (p. 138). As Shepsle (1989) states, 'the goal is coordination and the distribution of conflict' (p. 139).

The concept of institutional bricolage also represents how institutions may change. Institutional bricolage refers to 'gathering and applying analogies and styles of thought already part of existing institutions' (Cleaver 2002, p. 15). It refers to creating and designing an institutional framework from existing institutions to best suit changing behaviours. Such theory incorporates both historical perspective and a rational choice perspective in which new institutions are created and designed (not spontaneously emerging) from old institutions. The intentional intervention to alter institutions or develop new institutions reflects the overall process of 'institutional design' (Goodin 1996).

In summary, understanding institutional change is an important feature of institutional theory as it has implications for shaping and structuring behaviour within society. The above discussed the main perspectives on how institutions change from deliberate actions encouraged by those who wish to change institutions to evolutionary processes that explain the change.

3.3 Applications of institutional theory

This section looks at how institutional theory has been applied to analyse a number of issues, which are similar to the issue of EWF security.

Institutional theory is diverse. There are several different perspectives, definitions for institutions, approaches and applications of institutional theory to investigate a variety of issues. According to Nabli & Nugent (1989), these have included:

> *the analysis of behavioural norms, the integration of persons with different tastes and preferences into voting coalition, interest group formation, the problems of the prerequisite for collective action, transaction costs, organisation theory, limitation on the rationality of human behaviour, the emergence of rules of thumb for firm decision making, the determinants of firm structure, the coordination problems, rent-seeking behaviour, technological changes and its relationships to institutional change and the determinants and effects of property rights. (1989, p. 1334).*

A number of studies have applied institutional theory to analyse the influence of institutions in shaping behaviour typically over a course of time. In doing so, these studies have demonstrated, in addition to the applicability of institutional theory, an appreciation of institutions and

recognition of their importance in influencing socio-economic, political and environmental outcomes. These studies have provided insights for improving outcomes through the establishment of new institutional structures or the alteration of existing institutional structures. In these studies, the institutions measured ranged from a variety of forms from broad descriptions such as rules and norms, overarching governance systems to specific descriptions such as property rights and electoral rules.

3.3.1 Economic growth and development issues

Several studies, in particular, have included the analysis of the role of institutions in contributing to economic development and hence the need to consider institutions in the development of economic policy. In the context of economic growth, there is a widespread consensus that institutions play a crucial role in shaping economic performance (Gagliardi 2008). Studies investigating these issues generally adopted regression-based approaches to correlate measures of institutions on measures of income and economic performance, in particular, to explain variations of economic performance across different countries.

Measures of institutions vary across studies. In Scully (1988), institutions are measured by political, civil and economic liberties using indicators of political rights, civil rights, types of economic systems (capitalist, mixed-capitalist, capital-statist, mixed-socialist or socialist) and level of economic freedom. In Glaeser, La Porta, Lopez-de-Silanes and Shleifer (2004) institutions are defined as 'constraints on government' (p. 275) and 'permanent or at least durable features of the environment' (p. 275). The study included four measures related to electoral rules (plurality and proportional representation) and constitutional measures (judicial independence measuring the permanency in office of Supreme Court judges and constitutional review measuring the extent of judicial review of legislation). Both electoral rules and constitutional measures were seen to have both features of constraint and permanency.

Williamson (2009) similarly measured formal institutions using electoral and constitutional rules but also measured informal institutions such as culture, trust, respect, individual self-determination and obedience.[7] These measures were normalised into an index to analyse the differences between countries based on the strength of both their formal and informal institutions (measuring countries with strong formal and strong informal institutions; weak formal and strong informal institutions; strong formal and weak informal institutions; and weak formal and weak informal institutions).

[7] Data on informal institutions based on survey data (Williamson 2009)

Acemoglu and Johnson (2005) measured institutions in terms of property rights institutions that protect citizens against expropriation by the government and power elites, and contracting institutions that enable private contracts between citizens. Legal origin and mortality rates were also variables considered as influences on historical development and enforcement of rights. Property rights were also used to reflect institutions as well as the rule of law in Rodrik, Subramanian & Trebbi (2004). Savoia, Easaw and McKay (2010) measured the relationship between economic inequality and institutions, defining economic institutions comprising of 'growth-igniting' (p. 143) institutions (property rights) and 'growth-sustaining' (p. 143) institutions (factor and financial markets regulation), and as influenced by political institutions such as political democracy. Measures of inequality (GINI) were correlated with proxy indicators for institutions (security of property rights, democracy, constraints on the executive, political stability, government effectiveness and regulatory quality). Williamson and Kerekes (2011) also measured property rights but included both formal aspects including political constraints on government behaviour and informal aspects including private constraints such as norms and customs. In Griffiths and Zammuto (2005), a study to analyse sources of variation in industry performance and national industrial competitiveness, a framework was developed comprising four institutional governance systems (state governance, joint governance, corporate governance and market governance). These systems were representative of different levels of influence by state involvement, managerial hierarchies and markets and were analysed in terms of how the different systems respond to competitive environments.

In these studies, measures of institutions included both formal and informal constraints. Informal institutions were highlighted particularly in Williamson (2009) and Williams and Kerekes (2011). Other studies that highlighted the importance of informal institutions, such as those related to culture in economic development, include Tabellini (2010) and Maridal (2013). These studies however, varied in interpretation and choice of institutions in terms of defining and measuring institutions as factors that influence a particular process or outcome. Table 3.3 summarises the findings of some of the aforementioned studies, highlighting the importance of institutions.

Table 3.3: Economic growth and development institutional studies

Study	Findings
Scully (1988)	Institutional framework of an economy (political, civil and economic liberties and type of economic system) has a significant effect on economic performance. Politically open societies following the principles of the rule of law, private property and market allocation of resources, have grown substantially faster over time compared with other societies.
Glaeser et al. (2004)	Measures whether political institutions (electoral rules and constitutional rules) cause economic growth. The study finds that economic growth and enhanced

Study	Findings
	social capital give rise to better institutions which can furthermore continue to promote development. Institutions are influenced by economic circumstances.
Rodrik, Subramanian and Trebbi (2004)	Compares factors of geography, trade and institutions (property rights and rule of law) and finds that institutions have more significant influence on economic development. The study attributes differences in institutions to differences in economic incomes across the world.
Acemoglu and Johnson (2005)	Institutions (property rights and contracting institutions) are important as they protect citizens against expropriation by the government and powerful elites and enable contracts between private citizens and this contributes to economic performance.
Savoia, Easaw and McKay (2009)	Inequality has a role in shaping inefficient economic institutions.
Williamson (2009) and Williamson and Kerekes (2011)	Informal institutions play a more significant role than formal institutions in determining growth and development. Formal institutions are beneficial if they are aligned to informal institutions. The best performing economies are those with strong informal institutions, and those with the weakest economies tend to be countries where formal institutions are imposed without consideration of compatibility with informal institutions.
Assane and Grammy (2010)	Institutions that support economic freedom improve growth for developing countries helping them to grow faster.
Maridal (2013)	Emphasises the importance of cultural impacts on national growth and finds that culture, such that derives institutions, can be attributed to national differences in economic prosperity.

3.3.2 Environmental and EWF-related issues

The importance of institutions is also explored in studies concerning environmental issues and importantly, EWF-related issues. In the literature, the discussion of institutions is often in the investigation of questions about what institutions are needed to improve natural resource management and environmental governance. In these studies, institutions are used to describe the overall mechanisms and structures for governing the use of natural resources and the potential for new arrangements and rules to more appropriately improve environmental outcomes. For example, Acheson (2006) compared private property regimes, government control of resources and local management arrangements for resource management and discussed how each could fail in certain contexts. Therefore, the prescription of one being superior over others as a solution to all resource management issues was not appropriate. The analysis of the processes of institutional change in the context of transitioning towards sustainable development is explored in Gerber et al. (2009), examining property-rights and public policy. In Young (2010), institutions also referred to governance systems of environmental and resource regimes which reflect the way in which human-environmental relationships are steered. Young (2010) discussed how institutions persist as a result of institutional stickiness, and how they may change as a result of institutional stresses including pressures of worsening environmental issues that force changes in institutions.

Ménard (2011) discussed a new institutional economics perspective on environmental issues and emphasised the importance of organisational structures which are paid less attention compared with technological developments in providing solutions to certain environmental problems. Table 3.4 summarises some studies covering environmental and EWF-related issues.

Table 3.4: Environmental and EWF-related institutional studies

Study	Findings
Ostrom (1990)	Analyses the evolution of institutions for collective action for environmental governance to prevent over-exploitation of natural resources or common pool resources. Neither centralisation regulation or privatisation provides the most optimal solution. Through collective action, individuals can together improve natural resources management.
Imperial (1999)	Recognises the importance of institutions, discussing the framework for Institutional Analysis and Development in the context of ecosystem management. Improving coordination between organisations and changing institutional arrangements are needed to improve resource management.
Wejs (2014)	Focus is on examining the different approaches to climate change governance at the municipal scale in Denmark. Author analyses institutional mechanisms, including the events that have prompted climate change integration, how actions for dealing with climate change have been integrated and the need for legitimacy building to foster integration. Different sizes of municipalities affect the type of climate change strategies that are integrated and challenges faced.
Nilsson et al. (2011)	Describes how insights into institutions and politics can enhance energy future studies and contribute to public policy. In the context of the low carbon transformations of energy systems, authors examine how future system changes and policy paths are 'conditioned by institutional change processes' (p. 1118). Authors argue that effective governance of the transformation energy systems towards low carbon energy systems must be informed by appropriate energy-future studies that 'account for political and institutional parameters that impede or facilitate transformation' (p. 1118).
Vicchini (2007)	Institutional restraints exist in the Brazilian natural gas market
Genus and Mafakheri (2014)	Outlines an approach for understanding institutional rules, carriers, processes and mechanisms to understand the factors affecting the growth of bioenergy in the UK. Authors analyse four carriers of institutions, namely routines, relational systems, symbolic carriers and artefacts, discussing how each can foster new rules.
Mukherji and Shah (2005)	Analyses groundwater socio-ecology and governance, highlighting the importance of institutions and policies in groundwater management. Authors compare governance institutions including groundwater law, water markets as well as political ideology in South Asia, China, Spain and Mexico and examine how institutions and politics influence groundwater use, each country's groundwater situation and their overall governance of groundwater.
Saleth and Dinar (2004)	Apply institutional economics to examine the water sector in a variety of countries in light of an emerging water crisis, arguing that current engineering and technical approaches are inadequate. Institutions were reflected by water law, water policy and water administration (organisations) which impact water sector performance.
Sehring (2009)	Highlight the concept of path dependencies to describe the persistence of institutional rules, discussing water governance reforms (change to water institutions) in Kyrgyzstan and Tajikistan. Like Saleth and Dinar, water policy, water law and water administration are analysed. Water institutions are associated with rules, both formal and informal, that regulate water use.

Study	Findings
Merry and Cook (2012)	Uses institutional bricolage, 'active, conscious creative processes of adapting norms, values and social arrangements to fit new purpose, while also reflecting and being shaped by deeply embedded principles'(p. 8) to explain institutional changes in context of the water sector.
Akpabio (2011)	Examines the relationship between cultural perceptions, traditions and water resource management, highlighting their impacts on issues such as access, use, allocation and the success of state water projects. Using a case study on the Akwa Ibom State in Nigeria, the author examines the cultural importance of informal institutions and their influence on decisions for natural resource management. Author discusses the conflicts between state projects and policies and indigenous and traditional beliefs.
Kherallah and Kirsten (2002)	Discusses the applicability of the New Institutional Economics (NIE) framework to examine agricultural policy in developing countries. Authors list a range of agricultural issues that can be analysed using NIE, including contact farming, cooperatives and other farmer organisations, grades and standards, trader's behaviours and performance and access to agricultural input and rural credit markets.
Yami, Vogl & Hauser (2011)	Analyses the role of informal institutions (in Tigray, Ethiopia) to address shortages of grazing land, conflicts among users of communal grazing land and resistance among users to shift from free grazing to zero grazing.
Lăşan (2012)	Uses historical institutionalism, the concept of path dependency and critical junctures, to explain the reform processes of the Common Agricultural Policy (CAP) in Europe. Author finds that changes to CAP were difficult to implement as EU members were reluctant to deviate from the original agreements which have, over time, formed structures that have provided certain benefits to members.
Glover et al. (2014)	Examines the processes that have enabled the implementation of sustainable practices in the dairy supply chain in the United Kingdom, highlighting a shift from dominating cost-minimisation and profit maximisation norms. Author applies the concept of building legitimacy to the adoption of new processes by organisations, analysing behaviour and choices of firms.

Often institutions in the context of environment-focused literature referred to broader governance aspects. The literature on institutions in the context of EWF-related issues was similar as it also focussed on the analysis of the broader governance settings for EWF. Many focussed on specific and separate EWF-related issues (e.g. mitigating climate change or water resource management). The study of institutions in the context of governing water was a central theme as seen in Mukherji and Shah (2005) and Saleth and Dinar (2004) who both focussed on formal institutions such as water law and policy; Sehring (2009) and Merry and Cook (2012) who both used the concept of institutional bricolage to explain institutional change in the water sector and Akpabio (2011) who examined the relationship between culture and traditions and water resource management. Historical institutional and the concept of path dependency have also been used in the context of food-related issues as seen in Lăşan (2012) to explain the reform processes of the Common Agricultural Policy (CAP) in Europe.

3.3.3 Summary

This section gave a brief overview of studies that have applied institutional theory to analyse a number of issues, economic issues such as growth and development and environmental issues. The studies reviewed demonstrate the applicability of institutional theory while explaining the importance of institutions in influencing outcomes. It is apparent that institutional theory is broad and there are a variety of ways in which institutions can be analysed, depending on the type of issue of concern.

While studies varied in terms of the selection of institutions measured, questions about the influence of institutions (however defined) in governing and shaping outcomes, however, were shared, applied to explain variations in growth, understanding the potential for improved resource management or explaining reasons for institutional change. The insights gained from such analyses reinforce the need to consider institutions as factors that shape change.

Having reviewed the key characteristics and features of institutional theory and its applications, the next section discusses the relevance of institutions and the importance of institutional analysis, looking at the suitable concepts for analysing institutions in the context of the EWF nexus and EWF security. This relates to the main objective of this thesis to develop a broader understanding of the EWF nexus by examining its institutional dimensions.

3.4 Institutions in the context of the EWF security

From an understanding of institutions developed from the literature review, in the context of EWF, institutions are those associated with the governance of EWF, involving a complex interaction of both informal and formal institutions.

3.4.1 Informal and formal institutions in EWF

Informal institutions are those that shape attitudes, perceptions and beliefs about EWF. They also reflect perceptions of EWF security and how EWF securities are interlinked. These institutions include the constraints that individuals impose on themselves based on beliefs about what is socially acceptable. They define the constraints by which EWF are governed, influencing the use and consumption of EWF resources, as basic needs for survival and as important inputs for economic activity. These informal institutions associated with EWF vary across cultural contexts. However, given the increasing links between different cultures through globalisation, these informal institutions are also shaped by external attitudes, perceptions and beliefs.

These informal institutions (as previously mentioned), influence the formal institutions. Formal institutions are those that shape how EWF is formally governed through existing policy,

legislation, regulation, constitutions and other rules and structures. For example, this includes the laws and regulations that constrain EWF-sector behaviour and influence sector performance or the policy agendas that dictate the development of EWF sectors and how sectors meet broader socio-economic and political goals. Formal institutions are imposed on society and economy.

These institutions, however, are not isolated and they do not exist on their own as separate constraints. As shown in Williamson's framework (2000), higher levels constrain lower level institutions. Both formal and informal institutions that govern EWF are also connected with other formal and informal institutions. At the formal level, informal constraints associated with EWF are furthermore shaped by other informal constraints related to the wider environment (social and natural). These could include the rules that are believed to govern human relationships within society and with the environment and human development. Religious beliefs, economic and political ideologies are such examples. Informal institutions concerned with EWF cannot be separated from the institutions that guide overall human security, that define how individuals live within the natural environment and interact with each other, and that shape how individuals and societies progress. EWF security issues may reflect larger questions about current lifestyles and the ability for societies to live sustainably, causing minimal harm to the environment while simultaneously achieving economic development and ensuring a reduction in social and political problems such as poverty, corruption and violence.

At a formal level, policies, laws and other rules designed to govern EWF are linked with the existing formal institutions that govern other industries, economic sectors and the overall economy. For instance, laws that govern fair-trading and competition in the economy will apply to EWF sectors as well as other economic sectors. Higher-level institutions such as constitutions determine the power and authority of certain groups responsible for dealing with EWF issues.

3.4.2 The role of institutions in redressing EWF security

The security of EWF is critical for the survival of humanity. Around the world, different policies and laws are being designed, planned and implemented at multilateral, bilateral, unilateral, state and local levels to improve EWF security. There have been various strategies to improve EWF security including (but not limited to) reforms to EWF sectors (sector deregulation, privatisation or nationalisation), policies for regional integration (developments for regional energy systems), trade agreements, foreign land purchases, policies to increase or stabilise EWF supply through large-scale infrastructure projects (through dams, desalination plants, power stations, irrigation schemes), diversifying the supply mix (introducing renewable energies, diversifying crop mix), introduction of technologies to improve efficiency (power-saving and water-saving systems for buildings, vehicles or devices for personal use), conservation measures, changes to standards

(building development standards and appliances), as well as other smaller scale strategies. Strategies may certainly differ between the three resources and they also imply different costs, some requiring a substantial investment. Different policies may also depend on whether governments take an interventionist approach to redressing EWF issues.

As discussed in the previous chapters, concerns regarding EWF policies are that they are limited because they are designed with a narrow focus on sector-specific siloes of EWF, therefore dealing with EWF securities in isolation. The approaches for redressing EWF security are considered inadequate as they do not account for the interlinkages between EWF. EWF nexus literature emphasises the need to transition from a siloed approach for which a certain set of institutions exist, to a nexus approach for which new institutions may be required. These new sets of institutions must be informed by an understanding of EWF interlinkages. The development of new institutions however, requires an understanding of institutions, particularly in the context of EWF security. A discussion of the importance of institutions in the context of redressing EWF security is discussed below considering the need for awareness of inappropriate institutions, how institutional changes impact EWF security and barriers to institutional change.

Firstly, a lack of institutions or the existence of inappropriate or weak institution can be attributed to ongoing EWF issues. In the context of water security, Grey and Sadoff (2007) found that the lack of institutions in regulating and managing water technologies contributed to deteriorating water security. Few changes to the management, policies and practices to control the technical advances (in motorised drilling) allowed for unsustainable groundwater extraction. Khan et al. (2009) in their review of footprints in water and energy inputs in food production described the impact of institutions in influencing resource use stating that the existence of inappropriate policies and inadequate institutions create an environment for which farmers and other users lack incentives to use resources wisely. The studies by Berazneva and Lee (2013) and Maystadt, Tan and Breisinger (2014) suggested that food security in Africa and Arab countries was linked to political institutions, governance and conflict. The FAO and WFP (2009) suggested that furthermore, food security was a function not only of production and market access but also of the environment created by economic and political institutions. It was noted that institutions facilitate or obstruct people's access to essential livelihood assets.

Saleth and Dinar (2004) argued that the increasing severity of water issues, despite varying across different countries 'originates from inefficient use and poor management than from any real physical limits on supply augmentation' (p. 1). It 'stems from pervasive gaps in the economic and institutional dimensions of water resource development, allocation, use and management' (Saleth & Dinar 2004, p. 1). Most policies, they describe, focussing on technical and engineering approaches, are insufficient for dealing with the 'emerging resource realities, socioeconomic

concerns and development ethos' (Saleth & Dinar 2004, p. 9). Changing how water sector policies are formulated and implemented is an important step for redressing water security (Saleth & Dinar 2004) but in general changes to all institutional arrangements that currently govern water resources (legislation, regulation, administration and policies) will be required. While emphasis is on water, these issues are still relevant for energy and food issues.

Policy failures from a lack of consideration to institutions is seen in various examples. De Oliviera (2010) analysed the failure of policies to integrate the energy systems across countries in South America, intended to improve energy security. Failure was attributed to the lack of proper regulation, trading mechanisms and rules for increased energy flows which imposed barriers to integration, resulting in idle infrastructure and higher energy costs. Similar to the South American experience, while regional power exchanges were seen to be beneficial for South Asia's energy security, Singh (2013) noted that the existence of institutional barriers within the region impeded regional power cooperation. For example, in India and Bhutan, no effective institutional arrangements existed amongst members to facilitate cooperation. Furthermore, in developing Asian countries, a lack of governance practices and the inability to integrate policies and develop the necessary legal, regulatory frameworks to support water policy and implementation was also seen to be challenges to deal with water security (Biswas & Seetharam 2008).

Considering a historical institutionalist perspective, institutional change impacts EWF. This is exemplified in the context of Central Asia and the historical event of the collapse of the Soviet Union which had a strong impact on EWF issues in the region (Babu & Pinstrup-Andersen 2000; Baydildina et al. 2000; Zakhirova 2013). Before the collapse, much of the natural resources were managed jointly. As Zakhirova (2013) described, the collapse had the effect of dividing the region into water-rich and water-poor states, making new states unwilling to cooperate, despite the need for cooperation in dealing with water issues relating to the shared water resources in the region. Since the collapse of the Soviet Union, much of the progress to improve food security, an important goal for the region, has also been frustrated (Babu & Pinstrup-Andersen 2000). The dismantling of state farms after the collapse of the Soviet Union led to reduced productivity, reduced crops and declining food availability. As Baydildina et al. (2000) described, much of the increasing hostility in the region, as a result of the collapse, has been attributed to driving countries towards pursuing policies of self-sufficiency and away from cooperation. As discussed, Lăşan noted that path dependencies and the reluctance of EU member states have prevented changes to the Common Agricultural Policy.

The aforementioned describes how institutions can be a source of EWF security problems and highlights the importance of being aware of the potential institutional issues to prevent undesirable outcomes. When policies fail or deliver undesired outcomes, a substantial amount of

resources is often wasted, and the costs of keeping inappropriate institutions can remain high. Greater attention to institutions may help reduce policy failure.

The transition towards improved EWF security outcomes may not be a seamless process in which policies that are implemented will naturally bring about security. In the context of energy security, Noel (2002) cited by Chester (2010) argued that 'energy policies should be mostly aimed at 'making markets work' and 'letting them work when they do' (p. 892) . This view follows from the argument that 'competitive, determined output and prices should be the energy security objectives of governments' and that 'adequacy of capacity, affordability and sustainability (the goals of energy security) will follow as by-products of an unfettered market' (Chester 2010, p. 892). From this perspective, achieving security depends on these by-products but there is no guarantee that such will eventuate. Policies that treat security as a by-product may not be sufficient to properly redress EWF security. As Nilsson et al. (2011) emphasised, in contrast, it is essential to consider institutions to understand how policies and institutions are potentially 'hindering certain paths as well as which institutions need to be put in place in order to mobilise a specific development' (p. 1119).

In order to improve EWF security, new types of institutions or changes to institutions are needed, both in policy and what is required to support policy. Developing and implementing these policies and institutional structures is, however, a challenging task. This is because of the existence of transaction costs, the need for acceptance and the relationship between formal and informal institutions.

Changes to institutions, however may incur transaction costs. As transaction cost economics predicts from a rational-choice perspective, when the costs are higher than the benefits, policies will not be implemented. Examples of transaction costs include information costs and coordination costs (Imperial 1999).

Information costs refer to the 'costs of searching for and organising information' (p. 456). Information asymmetries can lead to disagreement on policies. For instance, policy makers, experts and the public may have a different understanding of the nature of EWF security and this may influence preferences for different strategies. Differences in the understanding of certain issues may influence the degree of attention these issues receive and their prioritization. Some may view matters as urgent to address while others may not, and this may lead to differences in the willingness to implement policy. Members of the public may not fully understand the impacts of new policies, causing them to be anxious, uncertain and unwilling to support change. Perhaps information is only fully understood amongst specialists and experts. Overcoming these information asymmetries, although important, is furthermore difficult as disseminating and sharing information may be costly.

Coordination costs refer to the costs invested in negotiating, monitoring and enforcing agreements about development and implementation (Imperial 1999). Coordination is specifically important for EWF security, particularly with the need to integrate EWF policies and introduce a nexus-based approach to govern EWF. Overcoming the sector-specific siloed approach for dealing with security may include restructuring or establishing new government organisations to link separate EWF governing organisations and entities. Dealing with EWF security may require inter-organisational coordination and inter-agency collaboration. This can be difficult to achieve if beliefs and ideologies of those needing to cooperate, differ and the cost of coordination is high.

Imperial (1999) discusses incentives for government agencies not to cooperate, share information or develop consistent policies. One reason is related to 'different statutory and budgetary responsibilities of different programs' (p. 452) which Imperial argues 'creates different constituencies and can lead to competing priorities and objectives' (p. 452). Each government agency, furthermore, will have different capacities for action, such as regulatory authority and technical expertise. Changing responsibilities, priorities capacities may create political conflicts (Imperial 1999).

As Wejs (2014) citing March and Olsen (1989) explained, coordination across sectors is furthermore difficult to achieve because 'different sets of institutional rules tend to evolve in the departmental "silos"' (p. 1019). It is difficult for sectors to coordinate if they follow different rules, have different incentives and have competing policy agendas. Imperial (1999) stated that it is 'reasonable for federal, state and local officials as well as private and non-profit organisations to resist implementing policy changes' (p. 452) that are costly or go against their organisation's interest.

The reluctance to change institutions reflects policy acceptance, an important factor to consider for institutional change. Change is difficult to achieve, particularly if such policies cannot gain both political and public acceptance. Acceptance is largely determined by the existing social values and norms held which limits the set of viable policies and strategies. The implementation of policies, the changing regulatory frameworks and laws depends on acceptance which is important for legitimacy. Legitimacy is defined by Suchman (1995) as a 'generalised perception or assumption that the actions of an entity are desirable, proper and appropriate within some socially constructed system, of norms, values beliefs and definitions' (p. 574).

The relationship between informal and formal institutions is furthermore an important factor that determines the likelihood policies achieve certain outcomes. Mantzavinos, North and Shariq (2004) emphasised the importance of both formal and informal institutions for policy that while 'policies consist of changes in formal institutions, outcomes are the result of changes in both formal and informal rules' (p. 79). According to North (1993), it is essential that change occur in

both formal institutions and belief systems for successful reform. Evolving norms of behaviour will support and legitimise new rules, however, this is a lengthy process. This presents another challenge for dealing with EWF security. While the need to redress EWF security is urgent and immediate, support and acceptance for the needed policies may need to be established. The changes needed to improve the governance of EWF to ensure EWF security may threaten the status quo or go against certain beliefs, leading to conflict, particularly if such change may disadvantage those who do not have sufficient bargaining power to prevent change or influence an alternative solution. A large part of redressing EWF security hence involves balancing interests and finding acceptance rather than finding the most logical and rational solution.

While technology is seen to play a large role in transforming economies and their EWF systems, not all solutions, despite how efficient and logical they may be, will be viable. Attitudes, perceptions and beliefs about technologies may cause the uptake of technology to be slower than accepted or cause obstacles for the overall promotion of technological solutions. Ménard (2011) described how the 'existing beliefs that water is a gift of Mother Nature (or God)' (p. 118) often creates resistance to water metering. This occurs even if its purpose is to make users responsible for their water consumption.

Akpabio's (2011) study of perceptions and management practices for water management in Nigeria highlighted the importance of considering informal institutions. The author found that in some cases, approval by a spiritual leader was often required before water projects received public support, showing the difficulty of gaining acceptance if local beliefs conflict. It was found that 'the locally rooted water management norms and beliefs were at odds with state water management principles, to the extent that imposing a modern system of solutions to water problems always caused conflict' (2011, p. 593). In the context of water, Akpabio (2011) stated that,

> *The imposition of commodity values, even if it is ostensibly done for the good of the community, often directly threatens the spiritual and social integrity of the area. This is because it alters the concepts of ownership and exchange or resources that, in turn, govern the nature of these spiritual and social relationships. To limit water use or impose a tariff is to limit the people's entitlements to life and to disconnect them from nature, as well as threaten their existence of livelihoods. (p. 593)*

Nilsson et al. (2011) in the context of low carbon pathways recognised the 'need for fundamental change of regulatory systems and policies in several policy sectors' (p. 1125) but argue that 'without changes in underlying norms and cognitive perceptions about what are the key problems

and appropriate solutions, there is little hope that adequate policies can be implemented' (p. 1125). Nilsson et al. (2011) highlighted the need for change in perceptions and norms for which changes in formal institutions depend on. Cleaver (2002) furthermore argued institutions may not be successful if they 'fail to recognise the depth of social and cultural embeddedness of decision making and co-operative relations' (p. 28).

This discussion developed an understanding of the importance of institutions particularly in the context of EWF security, showing that inadequate institutions could be a source of EWF problems, highlighting the need to develop more appropriate institutions. In terms of the EWF nexus, these institutions are those that consider and are informed by the interlinkages between EWF. Developing more appropriate institutions is a difficult task because of several factors: transaction costs, gaining acceptance and support and also the relationship between informal and formal institutions whereby informal institutions play a large role in determining whether certain policy paths are acceptable and appropriate. The same reasons explain the potential for path dependencies. A proper redress of EWF security will require more appropriate policy, planning and implementation strategies. An understanding of institutions can assist in developing more appropriate strategies as it provides a way of setting the domains for which policies can be selected according to what would be the most appropriate and viable. Ménard (2011) describes the importance of institutional theory in helping to frame and explore problems as well as point out conditions that solutions must meet.

3.5 Conclusion

This chapter completes the first part of the second objective of the thesis which is to develop an understanding on institutional theory with a view to propose a framework to develop an institutional perspective on the EWF nexus in the context of EWF security to overcome the gaps in the literature. This chapter provided the theoretical background needed for developing a framework to analyse institutional dimensions of the EWF nexus. The main points of this chapter are:

- Institutional theory reflects an appreciation of the influences of the broader context in shaping behaviour. Institutional theory emerged as a response to the limitations of reductionist approaches in mainstream analysis that oversimplified human behaviour. Institutional theory comprises both an old and new school of institutional theory seen in various disciplines such as political science and economics. Differences were in the consideration of informal forces and the assumptions concerning the individual.
- Institutional theory is diverse as seen in the varying perspectives offered by the different strands of institutionalism (including rational choice, historical, sociological and others).

Rational choice institutionalists assume rational and utility maximising behaviour of individuals while sociological institutionalists assume the importance of culture and actions based on appropriateness. Historical institutionalists emphasise changes over time.

- In general, institutions are constraints that shape and structure social behaviour, both informal and formal institutions. Informal institutions include conventions, moral values, social norms, ideologies and belief systems, whereas formal institutions include laws, regulation, policy and other formal rules. Informal and formal institutions influence each other.
- Institutions emerge and change in a variety of ways. Institutions may exist as a result of learning processes that eventuate into problem-solving processes that are repeated, they may develop slowly over time in response to changes in the environment or come into existence by accident. They may also be created deliberately. Emphasis has been on the human creation aspect of institutions to guide behaviour and achieve improved outcomes and goals.
- As seen above, institutional theory can be used to develop insights on a number of social, economic, political and environmental issues. In the studies reviewed that applied institutional theory, all recognised the role of institutions in shaping outcomes and as factors of change.
- Finally, in the context of redressing EWF security, institutions have an important role. Institutions (both formal and informal) essentially guide the governance of EWF. Consideration of institutions is needed to identity potential reasons for policy failure and explain outcomes. While redressing EWF security may require changes to institutions, these changes may be difficult to achieve as a result of a number of barriers. These include the existence of transaction costs, path dependencies as well as the need to ensure social and political acceptance, in particular to align informal institutions (values and beliefs) with the objectives of formal institutions. Such is required to implement change.

Given an understanding of the core concepts of institutional theory, the next chapter develops the framework for analysing the institutional dimensions for the EWF nexus in the context of Australia.

Chapter 4 Development of an analytical framework

This chapter completes the second sub-objective of this thesis, namely to propose a framework to develop an institutional perspective on the EWF nexus to contribute to the underrepresented topic of institutions that is apparent in the current EWF nexus literature.

The analytical framework is developed to analyse the institutions that govern the provision of EWF and that ultimately influence EWF security. Together, the institutions that govern the separate EWF sectors are analysed simultaneously as the overall institutional settings for governing EWF. In particular, these institutional settings are examined to identify the extent to which they have provided a framework by which EWF can be governed jointly, reflecting an integrated approach to EWF as a opposed to a siloed approach. The framework is applied in the context of Australia at both national and state levels to develop an in-depth case study. The proposed framework employs a *Levels of Institutional Analysis* framework involving four levels of institutions based on the work by Williamson (2000).

This chapter is divided into four sections. Section 4.1 presents the *Levels of Institutional Analysis* of the proposed framework to analyse the institutional settings for EWF. Section 4.2 describes the application of the framework to develop the case study and Section 4.3 discusses some considerations of the analysis. Section 4.4 concludes the chapter.

4.1 Levels of Institutional Analysis framework to analyse EWF nexus-based governance

The analytical framework is an *EWF nexus-focused Levels of Institutional Analysis* framework that aims to identify areas of integration inherent in the institutional settings for EWF. These institutional settings comprise multiple levels to capture and emphasise the complexity of governing EWF, showing how the extent to which EWF is governed in an integrated manner is influenced by the interaction of the levels of institutions.

The proposed framework combines relevant institutional theory, drawing from each of the rational-choice, sociological and historical strands. It is not limited to a particular strand as none of the individual strands provides a superior perspective by which to analyse the EWF nexus and understand the extent to which EWF are governed separately.

From a *rational-choice institutionalist perspective*, institutions are those developed for the purposes of achieving the desired EWF outcomes. The extent to which EWF are treated together

depends on how well they lead to 'optimal' EWF outcomes at the least cost. The existence of high transaction costs limits changes in policy and ways of dealing with EWF matters. From a *sociological institutionalist perspective*, the way in which the EWF nexus is understood however is based on perception and interpretation by different individuals where values, norms and symbols are relevant. In redressing EWF security, the consideration of linkages results when the linkages are recognised as important and when EWF are understood as coexisting domains. Nexus approaches result from an understanding that EWF are part of a holistic system whereas siloed approaches result from an understanding that EWF are separate units that operate independently of each other. From a *historical institutionalist perspective*, past institutional settings, for example, past policies, legislation, or decision-making structures shape and condition new policies for EWF. However, these may not necessarily be the most efficient or optimal policies. Historical institutionalism recognises that inefficient policy pathways, however, may be difficult to replace or remove as a result of path-dependency, requiring a 'critical juncture' to alter the direction of policy. Vested interests that seek to protect the status quo may prevent new types of institutions that may change how power is distributed, from being established. For example, they may seek to protect the current siloed approach to EWF if the prospect of integration may result in either a loss of power and authority or a compromise on resources. Each strand of institutionalism provides a means for understanding the EWF nexus. The framework proposed recognises the multiple and complementary perspectives as reflected by each strand of institutionalism.

In defining institutions, the framework in this research applies North's (1990) definition as 'the humanly devised constraints' (p.1) that structure social and economic behaviour and Saleth and Dinar's (2004) definition describing the purpose of institutions to achieve certain outcomes, either a 'human purpose' (p. 26) or a goal or 'to address a going concern' (p. 26). These definitions are used to highlight the importance of institutions and their role in redressing EWF security which itself is a human goal and of significant concern. Following from rational-choice institutional theory, it is assumed that those responsible for designing, formulating, developing or altering institutions, such as policy makers or governments at multiple levels, will behave instrumentally or rationally in selecting the most efficient policies or laws. However, drawing from sociological institutions, they are also assumed to rely on certain ideologies and values, allowing them to determine which policy directions and institutional settings are the most appropriate. Acknowledging the power play that takes place in decision-making, however, is important as the processes entailed in decision-making and consensus-building involve how certain ideologies dominate over others and how individuals and groups use their power to achieve their own agendas and self-interests. It cannot be completely assumed that those responsible for policy act towards a common and collective good.

The proposed framework emphasises the importance of both informal and formal rules, as categorised by North (1990) and Mantzavinos (2001). As mentioned, informal rules include conventions, moral rules, social norms (Mantzavinos 2001) as well as values, customs or codes. These are inherent in different cultures, traditions, religions, belief systems and ideologies. Informal rules are considered to be 'unwritten rules' whereas formal rules are considered to be 'written rules'. Formal rules include law and legislation, regulation, constitution, statutes or market rules. Informal rules define how EWF issues, as well as broader economic and social issues, are interpreted, influencing the creation and selection of certain formal institutions to support the redress of such issues.

Recognising the distinction between informal and formal institutions, the proposed framework employs the *Levels of Institutional Analysis* framework based on Williamson (2000) to reflect different levels of institutions that consequently shape behaviour. This framework is also similar to the Multi-level Perspective (MLP) by Geels and Schot (2007) for the analysis of socio-technical transition pathways in which the MLP is used to understand 'transitions as outcomes of alignments between developments at multiple levels' (Geels & Schot 2007, p. 299). In their model, three levels are included, niche innovations, sociotechnical regimes and sociotechnical landscapes. The MLP reflects the way in which transitions occur as a result of the interactions between processes at each level, suggesting the evolving nature of institutions.

A levels-based approach is chosen as it provides a way of structuring the analysis of institutions, particularly classifying the types of institutions into different levels, ordered into a hierarchy to demonstrate the influence of one set of institutions on another, of higher-level institutions on lower-level institutions, specifically how informal institutions influence formal institutions, for example, how guiding ideologies and philosophies (informal institutions) result in specific formal institutions. It also considers how feedback influences higher levels. As mentioned, both formal and informal institutions have an important role in structuring and shaping behaviour at individual, social, economic and political levels. The interaction between the two types of institutions and their enforcement characteristics influences the degree to which they constrain behaviour.

This framework can be used to analyse complex institutional settings that govern other multiple and interrelated sectors. It is also applicable to various scales as it can be applied to multiple countries to develop a cross-country comparison or applied to a single country or a state for in-depth analysis. For these reasons, a *Levels of Institutional Analysis* framework is appropriate. Other frameworks, such as the Institutional Analysis and Development (IAD) framework by Ostrom, while also useful and has been applied to analyse the EWF nexus (see, for example, Villamayor-Tomas et al. 2015), is not suitable for the scale of analysis in this research. In the

study by Villamayor-Tomas et al. (2015), the IAD framework was used to analyse specific value chains in the context of irrigation. Further, in the IAD framework, the focus is on the behaviour of actors involved in certain action situations constrained by the rules and the outcomes of behaviour. The components for analysis require a deeper level of detail that is out of the scope of this research. This research, rather than focussing on specific actor behaviour in EWF-related activities such as irrigation, focusses instead on the broader institutional settings that govern EWF.

4.1.1 Levels of institutions

In developing the framework, the first step is to identify what comprises the institutional settings that govern EWF (thus influencing EWF security) and to develop a hierarchy to demonstrate the influence of higher levels on lower levels. In this research, these include the institutional settings that shape the broader economic environment and those that shape the sector-specific environment of the EWF sectors.

The framework developed comprises four levels: Level 1 represents informal institutions and Levels 2, 3 and 4 represent formal institutions. Level 1 is measured by development philosophies as a means of representing ideologies (economic, political, social and environmental) and thus informal institutions. The subsequent levels representing formal institutions are categorised into Level 2 institutions of government (characteristics and functions of government) including the role of government, political party in power and bureaucratic structure (portfolio representation and ministerial responsibilities), Level 3 institutions of planning and development at the sector level (policy, rules and organisations) and Level 4 institutions of operations (including sector-specific processes such as pricing and structural features such as market arrangements).

Tables 4.1 to 4.4 describe each level, followed by a detailed discussion.

Table 4.1: Informal institutions – Level 1 Development Philosophies

Attribute	Measure	Description	Indicators	Justification
Economic & Political	Classical Keynesian Neoclassical	Economic ideologies on role of govt and markets. Considers influence of global context on national context, e.g. how Australia's shift towards a market economy corresponds to global shifts	Periods of high govt involvement or low govt involvement	Relevant as economic development philosophies influence subsequent institutional levels, i.e. governance settings (Level 2) in defining the role of government, giving rise to certain types of policies and legislation (Level 3). Philosophies suggest views on allocation of resources (government vs market) relevant to EWF
Social	Social values	Observed social values e.g. egalitarianism, fairness, multiculturalism	Evidence of social concerns e.g. affordability concerns, support for immigration	Relevant as social values influence broader policy. e.g., need to ensure affordability of basic needs is a moral value shaping policy objectives. Acceptance of cultural diversity in belief systems can shape immigration policies linked to overall nation-building and development policies.
Environmental	Environmentalism	Awareness of natural environment. Reflected in awareness in, e.g. resource scarcity (energy, water and food); pollution and environmental degradation (water, air, land), salinity and soil issues; global warming and climate change and other, e.g. genetic engineering (implications for food production). Considers influence of global context on national context, e.g. willingness of Aus govts. to participate in emissions reduction to achieve global targets	Resource scarcity, e.g. policies to address scarcity (energy conservation, water conservation) Pollution and environmental degradation, e.g. policies to address pollution, global warming and climate change, e.g. emissions reduction targets, renewable energy targets Other, e.g. policies for genetic engineering of food	Relevant as different levels of environmental awareness influence different policy directions. High environmental awareness may give rise to certain types of policies and legislation including environmental protection, water conservation, land use policies or climate change action. These can impact on production and consumption of EWF.

Table 4.2: Formal Institutions – Level 2 Government (Characteristics and Functions)

Attribute	Measure	Description	Indicators	Justification
Role of Government	Centralised vs Decentralised	Govt. control of economy and EWF sectors whether central govt. plays a dominant role or central govt. plays a limited role and control is devolved to lower level govts or private sector	Govt. role and responsibilities divided or shared across federal, state and local govts and private sector to identify centralised or decentralised control of EWF sectors	Indicates role of the govt. (reflects Level 1 ideologies) Differences in centralisation across sectors may indicate barriers to integrate EWF
	Public-Private Mix	Public and private sector involvement in economy and in EWF	Extent of public sector involvement in EWF sectors	Indicates scope for govt. to implement change in economy and in EWF sectors Indicates scope for govt. to integrate EWF responsibilities
	Roles and responsibilities	Specific responsibilities in EWF sectors	Primary responsibilities: policy-making, standard setting, regulation, service provider, asset owner, source of investment or financial assistance	Indicates type of involvement by govt. Indicates scope for govt. to integrate EWF responsibilities Shared roles and responsibilities may increase risks of overlaps or duplication with impacts on policy effectiveness
Intergovernmental Relations	Intergovernmental coordination	Nature of intergovernmental relations and means (processes or mechanisms) of coordinating federal and state activities	Existence of councils, special meetings, councils, forum or conventions to facilitate multi-level government coordination	Reflects how well govts. deal with certain matters. Unclear definition in roles may produce conflicts arising from duplication of work, contradicting policy directions and confusion of goals Important to consider intergovernmental coordination processes and how intergovernmental conflicts can impact EWF policy, e.g. national water objectives conflicting with state water objectives Possibilities of intergovernmental coordination for EWF inter-sectoral matters
	Financial Relations	Vertical Fiscal Imbalance - difference between revenue expended by states in excess of the revenue raised by states which is met by federal government	Federal payments to the states (total value and proportion of state expenses), e.g. EWF-related funding programs, general or specific purpose EWF payments	Indicates influence of federal govt. on state govt. particularly in EWF matters

Attribute	Measure	Description	Indicators	Justification
		payments. Focus on EWF sector related expenses.		
Government in power	Political party	Identifies the party in power, reflecting political ideologies	Terms served by each political party mapped across the period including leadership changes	Changes in govt. may indicate changes to policy, rules or organisations or explain certain policy direction
	Portfolio representation	Identifies representation of EWF as specific areas of responsibility of the government. Portfolios can be created, merged or separated over time.	Portfolio titles	Indicate importance of EWF matters at the govt. level highlighting govt priorities Designation of the portfolios can also indicate the level of separation of EWF responsibilities
	Ministerial Representation	Designation of EWF portfolios to ministers to identify integration between EWF responsibilities.	Ministerial titles	Indicate cross-sectoral responsibilities regarding EWF (one minister is responsible for EWF matters). May be a sign of greater integration and coordination of EWF efforts Indicate joint responsibility (more than one minister is responsible for a sector). May be a sign of fragmentation Indicate separation (one minister responsible for one sector).

Table 4.3: Formal Institutions – Level 3 Policy, Rules and Organisations

Attribute	Measure	Description	Indicators	Justification
Policy	Policy drivers	Overall policy drivers	e.g. Microeconomic reform to introduce competition in EWF sectors	Indicate priorities for EWF and areas of cross-sectoral linkages, e.g. the need to ensure water supplies to meet agricultural production targets or hydropower objectives
	Policy statements	Policy objectives, measures and strategies Identify scope of EWF policy with regard to inter-sectoral considerations and implications for EWF security	e.g. Policy White Papers	Indicate level of cross-sector integration at the policy level

Attribute	Measure	Description	Indicators	Justification
Rules	Acts	Key EWF Acts Identify scope of legislation, implications for EWF security and areas of cross-sectoral provisions	Sector-specific Acts Non-sector specific Acts but relevant to EWF, e.g. environmental legislation	Indicate the level of cross-sector integration at the legislative level
	Regulation	Key EWF regulation Identify scope of regulation, implications for EWF security and areas of cross-sectoral regulation, e.g. conditions or constraints related to water use or energy use	Sector-specific regulation	Indicate level of cross-sector integration at the regulatory level
Organisations	Government Depts. and Machinery Changes	Roles and responsibilities of relevant EWF government departments Identify scope of responsibilities and extent of integration of EWF responsibilities	Roles and responsibilities and minister responsible	Indicate cross-sectoral responsibilities regarding EWF (one department responsible for EWF matters - may be a sign of greater integration and coordination of EWF efforts Indicate joint responsibility (more than one department is responsible for a sector) - may be sign of fragmentation. Indicate separation (one department responsible for one sector).
	Other organisations (e.g. Commissions, Councils, Statutory Authorities, Special Committees)	Roles and responsibilities of relevant EWF non-government department organisations Identify scope of responsibilities and extent of integration of EWF responsibilities	Description of roles and responsibilities	*Same as above*

Table 4.4: Formal Institutions – Level 4 Pricing and sector arrangements

Attribute	Measure	Description	Indicators	Justification
Pricing	EWF Pricing	Processes that determine to price of EWF ranging from fixed, regulated and competitive pricing	Description of pricing method and components	Indicate whether pricing of individual resources explicitly accounts for cost of other resources and inputs and associated externalities
Sector Arrangements	EWF Sectors	Other arrangements are specific to sector	Description of relevant sector arrangements	Indicate other governance arrangements concerned with linkages between EWF

Level 1 – Development Philosophies

Level 1 institutions represent informal institutions. While informal institutions can be analysed at a micro-level by considering specific individual values, the analysis in this research is at a macro-level, looking at higher-level cultural aspects and ideologies at a national level, aligned with the scale of analysis.

Representing informal institutions, Level 1 institutions consider the apparent development philosophies as a reflection of ideologies, belief systems and moral values associated with individual and collective perspectives regarding how individuals and society should live and progress. This entails views about how the economy should operate, how society interacts with the environment, particularly with the natural world and how individuals interact with each other.

Developmental philosophies include economic, political, social and environmental dimensions. Economic and political ideologies include those associated with the role of government and the role of markets reflecting, for instance, Keynesian or neoliberalist philosophies. Others include the extent of protectionism and openness to trade which reflects the attitudes held about how the country should develop economically, as an open or closed economy. Social ideologies refer to attitudes and preferences regarding what society should look like. These development philosophies may include values towards egalitarianism and fairness amongst society, indicated by social concerns regarding the affordability of basic needs, including EWF. These values can shape policy objectives. Acceptance of multicultural population can shape changes to immigration policy which are linked to overall development goals of the country. In Australia, the cultural milieu is characterised by Western values originating from British customs and influence. Environmental consciousness is used to indicate the environmental dimension of development philosophies associated with the willingness of a country to deal with environmental issues and to protect the environment. This is indicated by efforts in environmental policy reflecting environmental objectives as priorities.

Development philosophies influence subsequent institutional levels and may explain the choices that governments make regarding economic and social development and EWF matters. These philosophies influence the broader institutional settings for the country (Level 2) in defining the role of the government, their involvement in EWF sectors and whether these sectors adopt market-based or government-led approaches. These philosophies suggest different views on the allocation of resources relevant to the allocation of EWF. Similarly, different levels of environmental consciousness may influence different policy directions, giving rise to certain types of policies and legislation (Level 3). High levels of environmental consciousness may give rise to policies and legislation for environmental protection, water conservation, land use

regulation or climate change action. These can impact on the production and consumption of EWF.

Development philosophies are measured over time to explore how they have evolved, examining the broader historical context at a global and national level to identify development philosophies that have shaped Australia's society and economy over time.

Level 2 – Government

Level 2 institutions represent the first level of formal institutions subject to the influences of informal institutions (Level 1 institutions). Level 2 institutions consider government, its characteristics and functions to which subsequent levels (policy and rules, and processes) are subject. Level 2 institutions represent national level institutions similar to the second level of Williamson's framework that includes the executive, legislative, judicial and bureaucratic functions of government as well as the distribution of powers across different levels of government (Williamson 2000, p. 598). Analysis at this level includes an understanding of government regime, political, bureaucratic and legal systems, and the constitution, resembling the earlier political science approach to analysing formal institutions (Lowndes & Roberts 2013). Such an understanding of the government's characteristics is required in order to understand the government's role and capacity in dealing with EWF issues. Level 2 institutions are associated with the nature of government involvement in the economy but more importantly in fostering EWF sector developments and the provision of EWF.

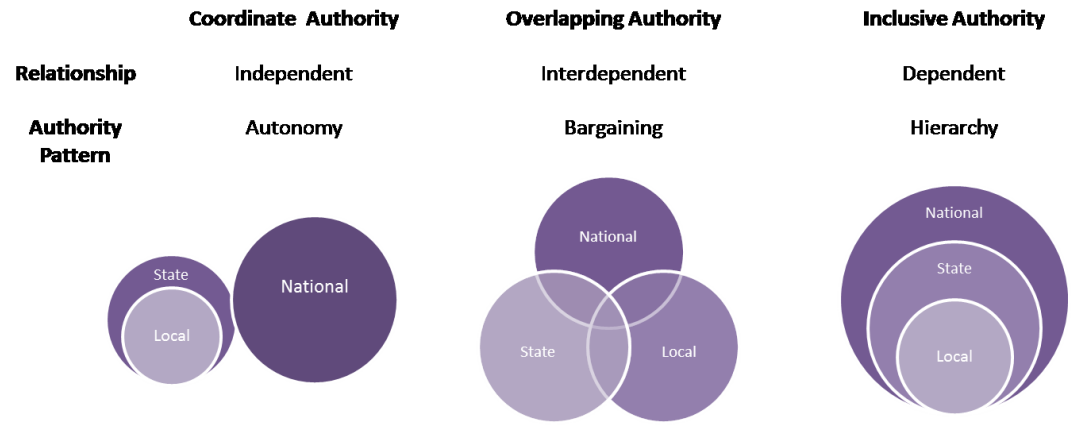
Australia has a federal, representative, ministerial and party system of government (Byrt & Crean 1972). It is a federation of six states that in 1901 decided to unify to form Australia. Powers are divided between the states and the central Commonwealth government, with the Australian Constitution specifying the powers of the Commonwealth with residual powers of the states. Australia has a representative government in that parliaments are elected by citizens and local governments by ratepayers and households. It has a ministerial system in that executive power in the Commonwealth and state parliamentary system is comprised of a cabinet of top-level ministers headed by the Prime Minister (Commonwealth) or Premier (state), responsible for directing government policy and dealing with national and state matters. With the multiple levels of government, the country also practises 'cooperative federalism' in which both levels of government work together in dealing with policy matters (Byrt & Crean 1972). These relationships, while not necessarily defined by the constitution, are supported by intergovernmental agreements.

Constitutions specify the responsibilities of national and sub-national governments and determine the distribution of power. In EWF matters, it is necessary to identify who has primary

responsibility as this has implications for policy making and implementation. In Australia, water and energy are the primary responsibilities of state governments. When the water and energy policies vary substantially across the number of states, this may result in a greater potential for policies to conflict. Policy conflicts may arise between governments at the state and national level, for example, where state government agendas conflict with national government agendas.

Analysis of Level 2 institutions enables an understanding of multiple-level government structures and their influence on how EWF systems are governed. Figure 4.1 displays three types of intergovernmental relationships, namely coordinate authority, overlapping authority and inclusive authority (Wright 1988). Different types of intergovernmental relationships suggest different levels of coordination between the multiple levels of government. This can have implications for the effectiveness of policies as they depend on how well responsibilities for EWF are managed and coordinated and how well conflicts between levels are resolved. The coordinate authority model shows the distinct boundaries that separate national and state governments. The overlapping authority model reflects when there is simultaneous involvement of all levels of government in certain matters. The inclusive authority model reflects the dependency of each lower level of government on the decisions of higher levels of government, revealing a clear hierarchy, unlike the first model which represents a degree of autonomy between the state and national governments. In this model, Wright (1988) describes the limited power of each level. Australia represents a coordinate authority model, given the degree of independence of the states.

Figure 4.1: Models of national, state and local relationships



Source: Wright (1978)

Level 2 institutions structure the degree to which multiple levels of government interact and coordinate their responsibilities for EWF to form policy and consider cross-jurisdictional and cross-boundary impacts.

Given an understanding of the government system, an analysis of Level 2 institutions focuses on three interrelated areas (reflecting both characteristics and functions): 1) federal and state (intergovernmental) relations, 2) political party in power and 3) government involvement.

Intergovernmental relations

Intergovernmental relations look at both financial dependency and intergovernmental coordination. The nature of financial dependency can influence the role that governments play. For example, dependency on Commonwealth government finances may limit the capacity of state governments to exercise their responsibilities. With power over finances, the Commonwealth government may influence what lower level governments may do. Hence, financial relations may obscure or complicate the roles of government, particularly in EWF sectors.

Intergovernmental coordination refers to two aspects, coordination between states and coordination between levels of government, including federal, state and local governments. The introduction of the federal government in 1901 enabled coordination between states (by the federal government) but this has also meant the need for intergovernmental coordination between the levels of government.

The importance of intergovernmental coordination is to reduce the conflict between states and the Commonwealth in dealing with common policy issues that arise from the degree of autonomy between states and the Commonwealth. In the context of EWF policies, the degree of conflict can have negative impacts on EWF outcomes including failure to implement a policy which is why coordination is needed.

Government in power

An analysis of the government in power examines changes in political parties (including leadership changes), changes in government ministers and changes in government portfolios. In Australia, the government is elected by the citizens and has a two-party system, the major political parties being the Labor Party and the Liberal Coalition.[8] Other majority parties seen at national and state levels have included the Country Party and the National Party. Political parties express different political ideologies and may have distinct policy offerings and priorities. Changes in political parties reflect changes in the policy preferences of the public based on which political party is elected.

[8] While the Liberal Coalition has served as the major party at federal and state levels, it is also important to acknowledge other major parties that have served in previous years. Moon and Sharman (2003) in their study of Australian politics over the last century categorise Australian political parties as 'Labor' and 'Non-Labor', with the latter to reflect over time the diverse group of anti-Labor parties (Liberal Coalition and others) that have served as opponents of Labor parties, at the federal and state level.

A party's priorities, however, are not only reflected in its policies but are also reflected in government portfolios which represent areas of government concern and responsibility. According to Moon and Sayers (1999), portfolios 'signify an area of commitment' (pp. 150-151) and indicate the government's scope and activities. The study analysed the scope of the government by looking at the range of the portfolios, indicating growth in the matters dealt with and intensity regarding the increased devotion to certain matters. Hughes (1984) analyses government portfolios and discusses the term 'symbolic reassurance' (p. 257) in which portfolios are used to symbolise government priorities (regardless as to whether these priorities are translated into government action or not).

In this research, government portfolios are used to indicate the government's responsibility, particularly in relation to EWF. The analysis is focused on portfolios for EWF and the extent to which EWF have been priorities and areas of government involvement. In particular, EWF portfolios will be analysed in terms of whether they are considered as combined or separate areas of responsibility. This is one indicator of integration. The next indicator of integration concerns ministerial responsibilities which involves the allocation of these portfolios to ministers, who maintain power and responsibility for such matters. Ministerial designations or portfolio allocations are analysed in terms of whether responsibilities are grouped or kept separate. Portfolio representation and ministerial responsibilities are features of government that indicate its priorities and involvement in EWF matters.

The bureaucratic structure is an important feature of Level 2 institutions, defining the number and types of portfolios, ministerial allocation and government departments (Level 3 institutions) at each government level. EWF responsibilities are framed as portfolios that are assigned to government ministers and different departments. This also represents the decision-making and policy-making chain. The integration of responsibilities will depend on the bureaucratic structure, for example, whether at the portfolio level, EWF matters are combined, whether ministers have multiple sector responsibilities, whether EWF responsibilities are combined under one department or whether there are platforms from which different ministers or departments can coordinate and communicate (for example via special forums or committees).

Changes in leadership and government can lead to changes in portfolios and ministers as well as policies and legislation (Level 3 institutions). Examining changes in government may explain changes in the degree of integration between EWF. It is important to note that in Australia, changes in portfolios and ministers occur as a result of the decisions made by the Prime Minister and Premiers, who, at their discretion, choose their cabinet ministers.

Government involvement

Government involvement reflects the role government plays in EWF sectors, its scope of power and the extent to which the government can influence changes in EWF sectors. While portfolios signal areas of concern, government involvement examines the capacity of governments to shape EWF sector outcomes. Three features are measured, namely the extent of centralisation, the public and private mix and the government's roles and responsibilities.

Centralisation refers to the extent power is centralised, for example, whether power is centralised at the federal level where the federal government has the most authority, whether power is devolved to local governments who have decision-making powers or whether power is decentralised with involvement by private sectors. An examination of centralisation indicates how responsibilities and power (over EWF matters) are divided and shared amongst the levels of government.

Public and Private Mix refers to the extent to which the government or private sectors are involved in EWF sectors. Low levels of involvement indicate little capacity of governments to make policy and implement change and vice versa. While the public and private mix indicates how the capacity to make policy or implement change varies across the levels of government, centralisation indicates at which level policy implementation may be more effective. Political capacity to act on EWF issues is an important aspect involving the extent to which actors are able to redress these issues. For example, van Steenbergen, Kumsa & Al-Awlaki (2015) described the lack of political capacity of state officials to solve groundwater issues because of the high involvement of local actors in managing groundwater, limiting the involvement by state officials. Both centralisation and public and private mix indicate the distribution of power.

Roles and Responsibilities refer to the responsibilities the government has in relation to policy-making and planning, regulation, standard development, service provision and other functions such as investment, assistance (financial and technical), infrastructure construction, or asset ownership.

The extent of centralisation, the levels of public and private mix and their responsibilities indicate the degree of control the government has and the extent to which it can influence change in EWF sectors.

An analysis of Level 2 institutions at the national level is important because it is where the socio-economic and political direction of the country is debated and decided. Broader socio-economic goals and the agenda (influence of Level 1 institutions) for the country will influence the specific goals and agenda for EWF sectors. Formal rules, including Level 3 institutions such as legislation designed to govern EWF, are also interlinked with the formal rules that govern other industries, economic sectors and the overall economy. For instance, laws that govern employer and employee

relationships, fair-trading and competition in the economy will apply to EWF sectors as well as other sectors.

The extent to which EWF issues are prioritised on the political agenda, which may or may not be reflective of public concerns, can determine the progress at which EWF issues (such as security) can be redressed. This can be seen in the existence of portfolios or policies for EWF and the level of resources (such as people, money, investment and time) devoted to dealing with these issues. This reflects the level of political commitment.

Policies and implementation strategies will vary according to the political parties who form a government, whose certain philosophies and ideologies may translate into particular policies and strategies that differ from those with other philosophies and ideologies. One typical example is market-based neoliberal approaches versus government-led involvement. Differences can also be seen in risk-averse governments as opposed to risk-taking governments who may be more willing to allocate greater resources to achieve a given policy objective. Other governments may be more conscious of spending taxpayers' money and may be more reluctant to make large investments for specific policies.

Level 2 institutions influence Level 3 and 4 institutions. In this framework, Level 3 and Level 4 institutions refer to those that are specific for governing EWF sectors, although Level 2 institutions also describe the bureaucratic structure concerning EWF in terms of portfolios and ministers. Government departments, however, are analysed as specific Level 3 institutions as organisations with specific EWF responsibilities.

Level 1 institutions also directly impact on Level 3 institutions. Informal institutions play a large part in determining the acceptability and legitimacy of specific policies and strategies to redress EWF security while the efficacy of formal institutions plays a large role in determining the success of a policy. Whether or not the proposed policies are politically and publically acceptable will determine the likelihood of resistance, implementation, and policy failure. This furthermore highlights the importance of understanding the informal institutional aspects related to EWF and using such information to inform policies to avoid failure.

While formal institutions are a conventional means for governing EWF, informal institutions may potentially have a stronger role. EWF may be predominantly informally governed as opposed to relying on formal institutions, as seen in Williamson (2009) and Williamson and Kerekes (2011). Common values, understanding, and knowledge concerning resources may lead to behaviour that protects resources without the need for a specific and enforceable law or formal punishment (for example, fines). For example, the moral value of avoiding waste may cause individuals to conserve EWF and avoid over-consumption.

Level 3 – Policy, Rules, Organisations

Level 3 institutions include sector-focussed policies, legislation and organisations (entities). The analysis of Level 3 institutions draws from public policy discourse and organisational theory, in addition to institutional theory discourse. It recognises the importance of institutions (both formal and informal) in shaping EWF policy and in structuring the network of actors (organisations) and their behaviour. The analysis of Level 3 institutions includes three domains: 1) the policy domain which represents policies, policy priorities and objectives, 2) the rules domain involving the relevant laws, regulations and other institutional rules that constrain and shape policy, structure power and people, and 3) the organisational domain which represents the persons (entities) involved (agencies or departments), their roles and responsibilities in implementing EWF policy. This is also linked to the bureaucratic structures described above.

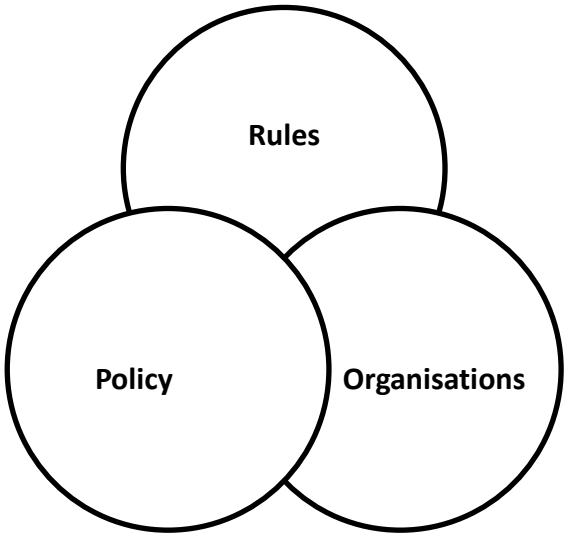
These three domains influence the success of policy to redress EWF security representing important factors contributing to the effectiveness of policies and their implementation and their ability to achieve intended outcomes. The analysis of Level 3 institutions follows an appreciation of the importance of the three domains, as seen in the work of Sharma, Misra and Yang (2014) in the context of geological disposal of radioactive waste and carbon dioxide. The study compared policies, regulation and organisation (and their responsibilities) for radioactive waste and CO2 disposal for a number of countries, arguing that the public acceptance of associated policies are determined by the efficacy of policy, regulation and organisations. The analysis at this level in this research recognises the importance of policy, rules and organisations in influencing public acceptance.

The analysis of policy, rules and organisations, however, seeks to identify areas of EWF integration, for example, whether sector policies or laws consider other sectors or whether organisations have combined EWF responsibilities. The proposed framework emphasises the interaction of these domains, the relationship between policy, rules and organisational domains, and specifically how integration varies between domains. This may further have implications on how the intended and desired policy outcomes are achieved.

Policy, Rules and Organisations

Figure 4.2 illustrates the interaction of policy, rules and organisations as interacting spheres. Although each sphere can be analysed alone, it is the interaction between each sphere that is important to understand because of their joint influence on policy outcomes.

Figure 4.2: Policy, rules and organisations



The framework highlights not only the importance of policy but also the rules (legislative rules and constraints) and organisations (composed of individuals with responsibilities over policy-making, implementation or regulation). The linkages between the three spheres are based on the public policy framework by Knoepfel et al. (2007) who described the policy process, the influence of (institutional) rules and the role of political-administrative arrangements, referring to the network of public actors or organisations. The framework developed here in this research proposes that the interaction and confluence of these three spheres are an important factor contributing to whether the desired policy outcomes are achieved.

Policy, as defined by Knoepfel et al. (2007) refers to

> *...a series of intentionally coherent decisions or activities taken or carried out by different public – and sometimes – private actors, whose resources, institutional link and interests vary, with a view to resolving in a targeted manner a problem that is politically defined as collective in nature. (p. 24)*

The authors implicitly referred to 'a large number of legislative and administrative activities aimed at the resolution of real problems' (p. 24). The decisions that determine policy by the relevant actors are 'aimed at channelling the behaviour of a target population so that a collective problem that society is not in a position to manage on its own can be resolved by public effort' (Knoepfel et al. 2007, p. 24). This highlights the importance of government involvement.

Policies reflect decisions concerning a set of activities to resolve a certain public issue requiring a concerted effort by the public and also private actors. Policies that target EWF issues aim to change the behaviour of individuals, the general public or specific industries, to alter EWF outcomes including security.

Rules within the analysis of Level 3 institutions refers broadly to the set of formal institutions that are entrenched, such as legislation or regulations that specify what is permitted by the law. Although this can also refer to constitutional rules that are analysed at Level 2 of the framework, the rules that are analysed at Level 3 are those that are specific to EWF. While legislation is formal, institutional rules can also be informal, for example, in norms and codes that are followed out of habit.

The difference between the policy and the rules components is that although policies (a set of activities) may be designed for the long term, their direction or the policies themselves may change depending on external changes, such as in the economy (e.g. the onset of economic crisis) and in the government (e.g. changes in political leaders, ministers and politicians). Rules defined by laws are long-lasting and difficult to change. For example, repealing or amending legislation requires formal government processes that seek agreement from both houses of parliament. This is similar to informal rules associated with culture or religions, shaping values, beliefs and ideologies that are also difficult to change. Formal rules include those that are established to shape the conditions for which policies are formulated or implemented. Policies can be enshrined into legislation.

Knoepfel et al. (2007), from a top-down perspective, describes three levels of institutional rules: 1) the *institutional frame* that comprises the constitutive rules of public policy. It involves principles defined by the constitution (e.g. direct democracy, federalism, constitutional, individual state liberties, and legislative, executive and judicial authorities); 2) the *institutional rules* that govern the administrative organisations and their resources, e.g. the hierarchical organisation of ministers and; 3) the *political-administrative arrangements* (PAA) related to the structured group of public actors charged with the development and/or implementation of a particular policy. These three levels described by Knoepfel et al. (2007) are incorporated into the proposed framework. It considers the country's constitution, federal system and separation of powers, financial relations, ministry structures and organisations with EWF responsibilities. The organisational domain consists of individuals or groups that have a role in implementing policy and is the next component of Level 3 analysis.

Organisations, in this framework, refer to the entities, either an individual or groups with responsibilities for EWF, associated with, for example, the development and implementation of policy, regulation and rules as well as enforcement, administration and monitoring. These

organisations can include governing bodies or other actors, either government or non-government, or independent departments or agencies with varying levels of authority and power. Their purpose is to address EWF matters through implementation of policy to govern and control the direction of EWF activities.

Organisations are an essential component of institutional settings at Level 3. They represent the human element by acknowledging the role of people who implement and maintain policies and whose interests, attitudes, actions and behaviour determine how policies come into play or do not come into play (Wright 1988). Hall and Quinn (1984) discuss organisations as the means for public policy implementation, for public policy formulation and also as the object of public policy, where policies target the creation of or changes to organisations. It is important to clarify that the term *organisations* used in the context of this research is not synonymous with the term *institutions* that is also used to refer to organisations. It is the role of organisations amongst the role of policies and rules that are described as institutions, not the organisational body itself.

In Australia, there are numerous organisations with important roles in EWF sectors and responsibilities for EWF matters. These organisations are spread across all levels of government and also over different supply chain activities. The focus of organisations in this framework is on those with policy-making powers, rule-making powers, with regulatory responsibilities or with service provision responsibilities – those organisations that have a significant role influencing the development of the sector and the provision of EWF services. While private actors and non-government actors may have a strong influence on policy, in formulation and implementation, they are numerous and not included in the scope as they do not have direct policy-making powers, rule-making or regulatory responsibilities. Private actors are discussed in the context of public and private involvement. Their actions and behaviour are governed by public organisations.

Interconnections and relationships between policy, rules and organisations

While policy, rules and organisations separately have different roles, the interaction between the domains is highlighted. This is because their interaction has implications for the effectiveness of policy which also determines policy acceptance. While two-way interactions are often discussed in the policy and organisational literature (that is, the interactions between policy and organisations; policy and rules; rules and organisations), and while the importance of all three domains is highlighted in Knoepfel (2007), the framework developed here emphasises the interaction of the three components.

a) Policy and rules

Policy and rules have a two-way influence. Policies are constrained by existing rules, but they are also the means for creating new or changing old rules. Policies may highlight the need to create

new rules or turn a policy into a legal act. Policies also influence which lasting and stabilising institutions come into being or how they evolve.

Policies are influenced by informal rules (morals, beliefs, traditions and others) that shape the way in which policy problems are perceived. This furthermore represents the influence of Level 1 informal institutions on the creation of Level 3 formal institutions. Certain policies may be priorities for some and not others and this impacts the agenda-setting stage of the policy process. Formal constraints such as existing laws can also constrain policies, for example, new water policies will be subject to and constrained by the rules specified in water legislation; similarly, food policies and energy policies that involve changes to water use will also be constrained by water legislation. These rules influence policy formulation and implementation.

b) Policy and organisations

Policy and organisations have a two-way influence as policies allocate responsibilities to individual organisations and organisations (such as government departments) have an important role in advising ministers, assisting policy development and implementing policies. The relationship between policy and organisations is seen in both public policy theory and organisational theory (see Gray 1989; Hall & Quinn 1984; Wright 1988).

c) Rules and organisations

The structure, hierarchy and responsibility of organisations, for example, the structure of government departments, the distribution of power across departments and within departments, and the establishment of a public agency, such as a statutory agency, are defined by rules. Rules concerning power could include the separation of power specified in the constitution (Level 2). Rules also have an impact on the stages of the policy process, for example, on the agenda-setting and formulation stage. Organisations (e.g. regulators) also enforce and administer rules (legislation or regulations). Informal rules will determine how policy problems are perceived and whether they are priority of organisations. For example, organisations develop shared beliefs, values and priorities and each organisation may have different approaches to similar issues. While one organisation may find that a specific policy problem requires urgent attention and resources, another organisation may find that the same specific policy problem does not. The relationship between rules and organisations is seen in Scott (1995) and Powell and DiMaggio (2012).

Consideration of the three domains (policy, rules and organisations) and how they impact and facilitate each other is important as they influence policy outcomes. Policies implemented without the necessary conditions in place to support them, such as regulations and the appropriate organisation to oversee implementation, are likely to fail or achieve sub-optimal outcomes. An understanding of the goals of EWF security and the desired outcomes, in particular with an

emphasis on an integrated approach to EWF, will have implications for how policies are formulated and who is responsible. The application of this framework enables the analysis of the existing policies, rules and organisations (at national and state levels) to review whether such are conducive to redressing EWF security, based on the level of integration between EWF. Harmony across policy, rules and organisations is required to enable the support of common goals and to reduce the likelihood of contradictions in policy and ineffectiveness.

Level 4 – Pricing and other sector-based constraints

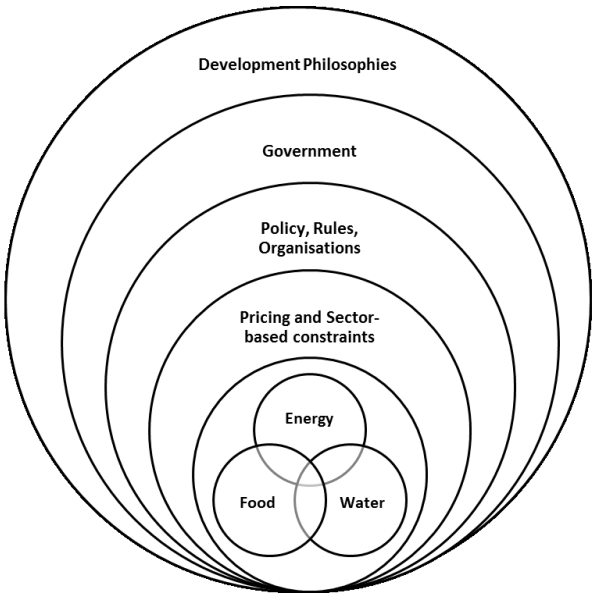
Level 4 institutions are associated with pricing and other market sector arrangements (either resulting from broader sector policies or legislation) specific to EWF. Level 4 institutions are multitudinous, covering a range of aspects. These institutions can include economic regulations, such as pricing, financial procedures in accounting and investment evaluation, business operation processes, technical regulations, safety standards, specific codes of conduct, planning processes, environmental impact assessments as well as labour regulations. Such institutions comprise the next level of institutions shaped by the previous policy, legislation and organisational level of institutions.

The analysis of Level 4 institutions in this research includes pricing processes. Prices are important in the allocation of EWF resources as they can influence the consumption of these resources. Economic and political ideologies influence types of pricing principles, for example, changes in pricing principles can be observed in countries that have transitioned towards more market-based societies, such as Australia. Pricing determination processes for EWF are analysed to identify whether impacts on other EWF sectors have been considered, or whether these impacts are treated as externalities. Other market arrangements are also examined to identify other potential areas of EWF integration.

Summary

The proposed *Levels of Institutional Analysis* framework captures four institutional levels comprising different components that together form the overall institutional settings to govern EWF. It considers the most immediate institutions to the broader level institutions, from pricing processes and market arrangements, policy, legislation, government involvement to development philosophies (see Figure 4.3). The figure shows EWF and the degree of the integration (shown where EWF intersect) as governed by a hierarchy of institutions. Each level is subject to the constraints of the levels preceding it. While each level can be analysed on its own, it is the relationships between all levels that enable a more in-depth understanding of the forces that shape institutional settings, the nature of the settings and in particular, integration.

Figure 4.3: Levels of institutions governing energy, water and food



The analysis highlights the relationships between levels, for example, between portfolios, ministerial responsibilities and organisational responsibilities (Level 2, Level 3) and how the integration of EWF responsibilities are reinforced or weakened across the levels. It looks at how ideology and development philosophies define the level of government involvement which then determines the scope in policy-making. It also considers how intergovernmental coordination influences the harmonisation of different state policies.

4.2 Application of framework to analyse EWF nexus

4.2.1 Scale and scope

This analytical framework will overcome the limitations of current research by giving equal representation to EWF, avoiding sector-bias by applying it at a neutral scale, that is, at a country level, rather than at a trans-boundary water-body level in which water issues tend to be prioritised (as seen in a number of studies). The framework considers the importance of EWF at a national level, where policy and lawmaking have nation-wide effects.

The framework is applied to examine institutions at both the national and state/territory level (that is, the Commonwealth, New South Wales, Victoria, Queensland, South Australia, Tasmania, Western Australia, the Northern Territory and the Australian Capital Territory).

The need to analyse both Commonwealth and state levels is due to the states' primary powers, particularly over energy and water. Hence, an analysis of EWF institutions would be limited

without analysis at the state level. The case studies account for the differences between jurisdictions and potential tensions between levels and between states across five time periods of Australia's history. These time periods are:

1. **Early Settlement and Colonial Development (from the late 1700s to 1900)** with emphasis on the mid-1850s, the establishment of self-government in the states and the early developments in EWF.
2. **Federation, World War I and the Great Depression (1901 to the late 1930s)** looking the key events that shaped the role of government, particularly in the EWF sectors.
3. **World War II and the Post-War Economy (from the late 1930s to the late 1960s)** looking at the adoption of Keynesianism during the war and post-war period, and the growing role of the government in all economic matters (including the development of EWF sectors).
4. **Economic Reform, Globalisation and Environmental Awareness (1970 to the late 1990s)** looking at the transitionary period of reform from a heavily-involved government towards a market-based neoliberal economy, contrasting significantly from previous periods.
5. **Post-Reform Economy and Contemporary Challenges (2000 to the present)** examining the continued efforts to ensure growth and development. It also discusses the contemporary challenges related to emerging EWF security challenges.

Table 4.5 and Figure 4.4 show the overall procedure and framework, followed by a description of the procedure.

Table 4.5: Analytical Framework – Broad Overview

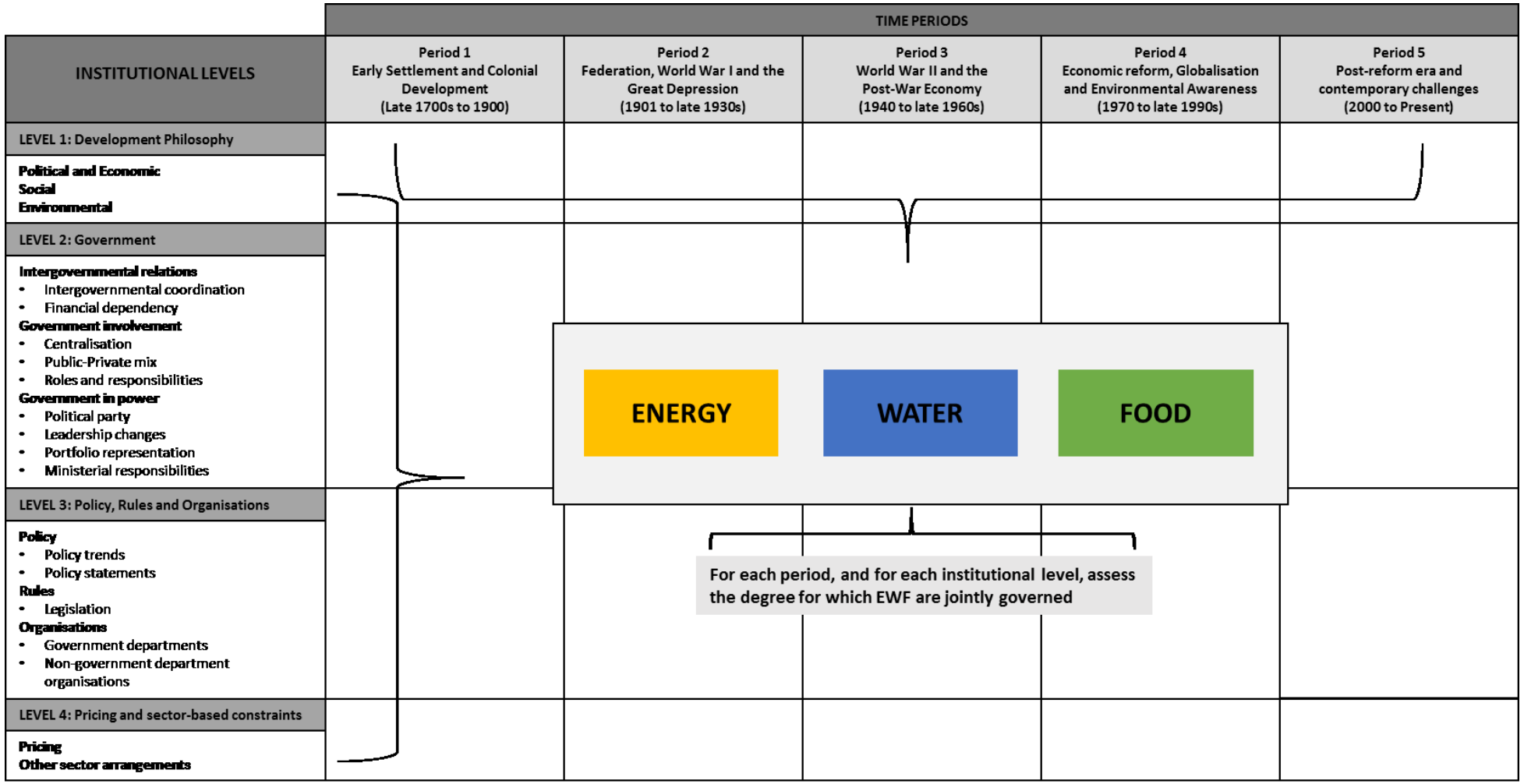
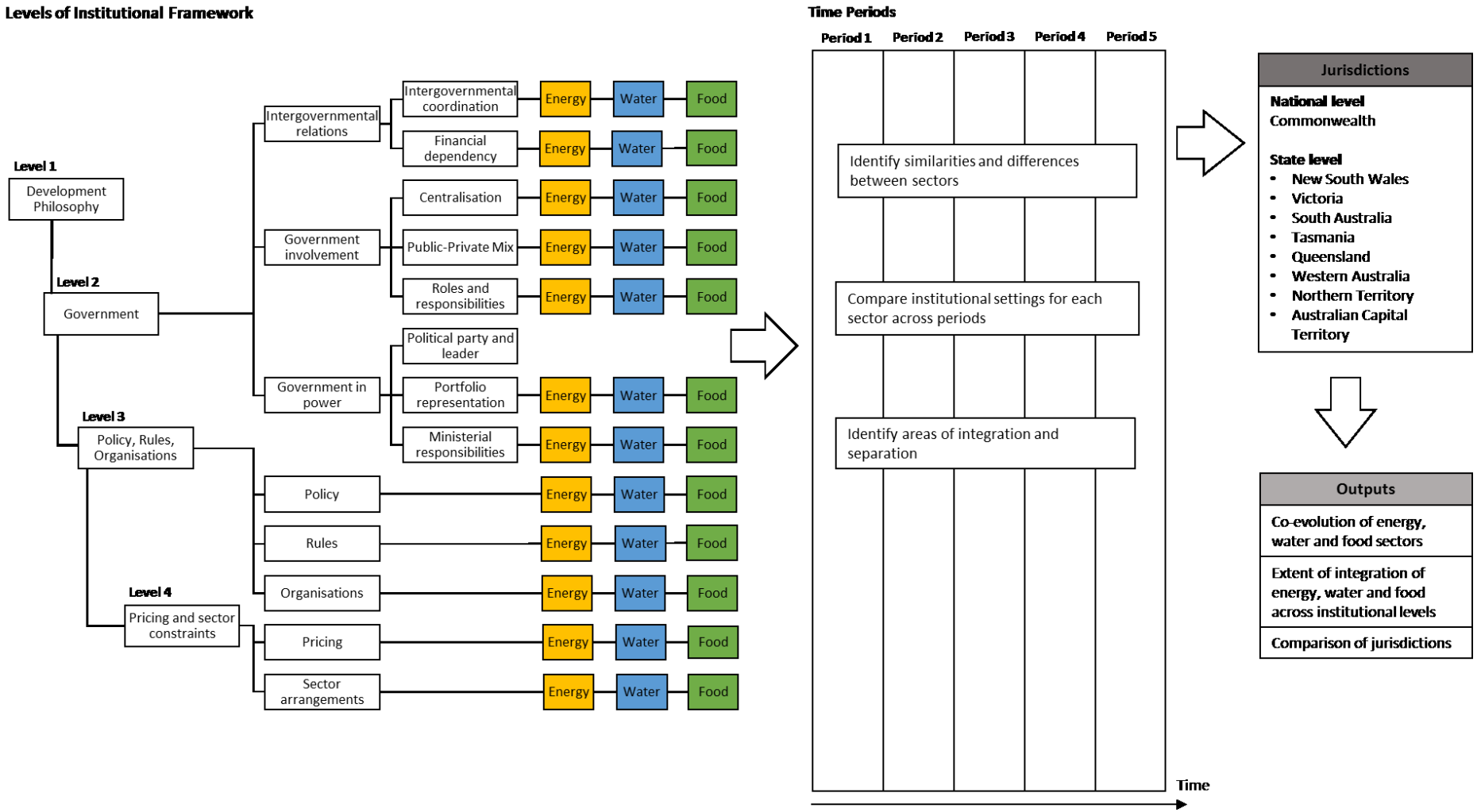


Figure 4.4: Framework Application Procedural Overview

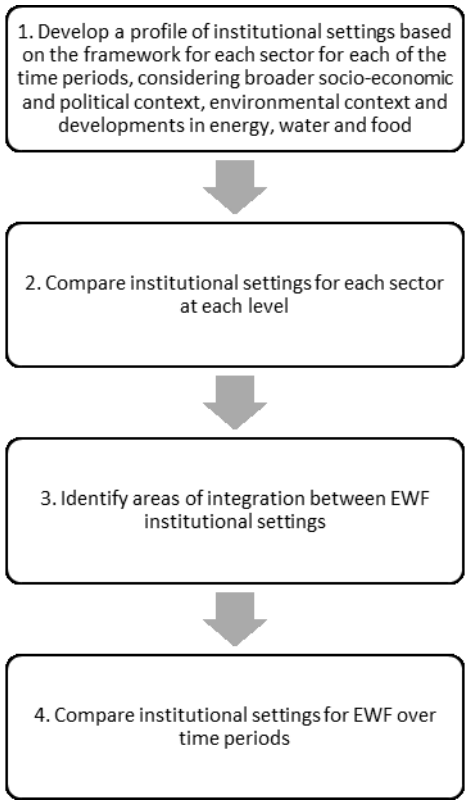


4.2.2 Procedure

For each period, EWF developments are described and a profile of institutional settings for EWF is developed, examining dominant development philosophies, changes in government, leaders, portfolios and ministers, through to policies, legislation and organisations to pricing processes and other sector-based constraints (reflecting each level discussed above).

Inferences are drawn from the patterns found within each level as well as across levels to suggest the influence of *levels* on subsequent levels and potential feedback, where changes in lower levels lead to changes in higher levels. The analysis of institutional settings over each period is then compared across all periods to identify trends and patterns to indicate how institutional settings for EWF have evolved. The analysis will also require an understanding of the wider economic, political and social context underpinning the EWF sector developments.

Figure 4.5: Procedure Description



A major part of the analysis is to identify areas of integration. Table 4.6 describes how each level will be analysed with regard to identifying the extent of integration between EWF.

Table 4.6: Identifying siloed and non-siloed approaches to EWF

Government Involvement	
The scope of government responsibilities	• Similar degree of government involvement and responsibilities across EWF matters at each level of government to reflect opportunities where EWF responsibilities can be coordinated and integrated • e.g. if state governments have similar responsibilities or a similar level of involvement across EWF sectors, there is potential to govern EWF jointly
Decision-Making, Policy-Making, Implementation and Administrative Chain	
Portfolio Representation	• Existence of mixed portfolios (whether EWF matters are grouped into one portfolio) • e.g. Minister for Energy and Water Supply is responsible for a mixed portfolio
Ministerial Responsibilities	• Allocation of multiple portfolios and or mixed portfolios to a minister, making them responsible for at least two or all three sectors • e.g. one minister such as the Minister for Energy, Minister for Agriculture and Water Supply suggests integrated decision-making regarding EWF-related matters • Ministerial responsibilities are also indicated by government department responsibilities for which ministers are responsible
Organisation Roles	• Roles and responsibilities for EWF policy, implementation and programmes fall into the scope of one department rather than separate departments.
Policy Outputs	
Policy	• Joint policy-making, where policies are developed in relation to all three sectors • Sector policies that articulate strategies or measures that involve other sectors or highlight linkages with other sectors in terms of possible inter-sectoral impacts • Sector policies with major references to other sectors indicate general consideration of other sectors • Sector policies with minor references to other sectors indicate some consideration, but the policy may be mostly sector-specific
Legislation and Regulation	• Joint-legislation, where legislation is developed in relation to all three sectors • Sector legislation considering other sectors, in terms of impacts on other sectors • Sector legislation with major mention of other sectors • Sector legislation with minor mention of other sectors
Pricing Processes	• Existence of joint-pricing processes • Sector pricing processes account for impacts on other sectors or whether other sector input costs are highlighted
Other sectoral arrangements	• Linkages between other sectors exist

*Other sector is used to refer to the other two sectors in relation to the sector in focus. For example, energy policies are reviewed to identify consideration to water or food sectors (other sectors)

The proposed *Levels of Institutional Analysis* framework provides a means of analysing both informal institutions (although at a generalised level) and formal institutions. Both have important roles (directly and indirectly) in governing EWF.

The analysis in this research is based on developing an understanding of the appropriateness of institutional settings to redress EWF security, focussing on the extent to which all levels of institutional settings provide a means for EWF to be governed together or separately. It focuses on the degree to which institutions reflect a siloed or an integrated approach, hence with implications on EWF security.

In analysing Level 3 and Level 4 some interrelated key questions include:

- What is the extent to which EWF linkages are considered in EWF policy, rules and organisations and also pricing? For example, is there evidence of integrated policy or laws, or cross-sectoral responsibility within relevant departments or evidence of EWF components considered in pricing these resources?
- Are the current policies, legislation and organisations adequate to deal with EWF security challenges based on the extent to which EWF linkages are considered?
- Is there a need and scope for change? What are the barriers to change? Does this have implications for higher levels or reveal that higher levels are also inadequate to redress EWF security?

In analysing Level 1 and 2, questions are related to whether such institutions can support the change required within Level 3 and 4 to better deal with EWF issues as well as whether institutions are a source of separation. This analytical framework enables the identification of certain barriers to change for Level 3 and 4 institutions, and these barriers can be associated with higher-level institutions. This can include, for example, the level of difficulty in reforming the bureaucratic structure, the difficulty of putting EWF issues on the political and economic agenda or the level of political capacity that certain levels of government have in introducing change and supporting the transition. Furthermore, perhaps dominant ideologies and mainstream development philosophies do not encourage holistic, integrated approaches and hence are not suitable or conducive to ensure EWF security.

The redress of EWF security challenges will depend on the influence of all levels of institutions, not only the role of policy, rules and organisations. This framework aims to capture such influences. While the policy element receives much of the attention in the EWF nexus literature, there is less attention on the role of other institutions, for example, rules and organisations, which are subsumed within a discussion about policy, and less attention on the broader institutional context (government involvement, political system and development philosophies). An

application of this framework is intended to develop insights to contribute to existing knowledge on the EWF nexus and how to redress EWF security.

4.3 Considerations

4.3.1 Complexity of EWF linkages

There are multiple relationships that exist across institutional levels, linkages that exist horizontally across sectors and those that exist vertically across multiple levels of government. The analysis of these multiple linkages reflects the potential flow-on impacts of policies (across sectors and across jurisdictions). Understanding the adequacy of institutions requires an understanding of these multiple linkages. The implementation of new policies, rules or the establishment of more appropriate organisations that are more nexus-based may be hindered by barriers that exist as a result of these horizontal and vertical relationships. The integration of EWF is not only associated with the horizontal integration of sectors but also vertical integration across the levels of government.

For Level 3 institutions, the analysis aims to identify the extent to which there is horizontal integration between EWF evident in policy, rules and organisations. The analysis looks at the role of policy, rules and organisations as they impact sectors. The analysis of Level 4 institutions analyses the extent to which, for example, the pricing methods consider the impact on or of other sectors or resources - whether energy pricing considers the impact on water or food.

EWF are different resources and belong to systems with different characteristics for which there is a tendency for siloed thinking and few experts in all fields of EWF (Bazilian et al. 2011). The extent to which 'siloed' approaches are entrenched impacts the ability to modify current institutions to move towards a nexus approach. The ability to share knowledge and information is limited as a result of different experts and the use of a different technical language which, when used outside the specific field, leads to misunderstanding and potentially a misinterpretation of policy issues. Users of information may not understand sector-specific language. Differences in priorities, goals and interests developed within sectors also act as barriers to coordination and more likely, sources of competition between organisations of different sectors that compete for resources. Path dependencies may also prevent a change in organisational behaviour.

The extent to which EWF are integrated can differ across multiple scales and levels of government. As described in Chapter 2, Scott et al. (2011) discussed resource linkages 'coupling' at multiple scales. Resource coupling refers to the interdependence between the three resources and that these linkages not only occur at the level of production or operation, they are linked at higher levels such as the regional level of natural resource stocks. EWF policies, rules and

organisations can vary across different levels of jurisdictions at the national, state and local level. National-level policies may involve domestic socio-economic goals that define the general direction of EWF sectors, for example, to improve production volume or increase competitiveness. They may also include meeting international obligations (e.g. emissions targets). At the state level, goals may be similar but specific to a certain area and, at a local level, council policies could include food safety standards or household water recycling. Policies developed at higher levels may have implications on policies at lower levels, for example, transboundary water agreements that govern water use between states shape water policies within relevant states or regions where shared water bodies are located. In the context of transboundary water basins, the energy and water policies of one state may impact the agricultural sector of neighbouring states. This suggests that policies in one jurisdiction may have impacts outside its boundaries.

There are multiple linkages between EWF institutional settings across sectors and levels of government and an understanding of these linkages can help trace the important policy impacts both vertically and horizontally. For example, national energy policy can impact on water usage at a state level or a state-level water policy can impact on food production at an aggregate and national level. National policies for a certain resource may also impact policies at the state level with the potential for conflict. For example, a national food policy to increase production may impact the water resources shared between multiple states. These impacts may give rise to unintended and undesirable policy outcomes across sectors, resources and jurisdictions. This is an important question for policy-makers seeking to reduce the negative impacts that one policy may have on another. Interdependent supply chains furthermore add complexity to the analysis of linkages, as each EWF system can be separated into their relevant upstream, midstream and downstream activities. Different policies and rules can apply to only one stage of the supply chain process and have impacts on another stage of another resource.

4.3.2 Historical analysis

While the application of the framework can be carried out to analyse institutions at a point in time, it can also be applied to carry out a historical analysis to understand how institutions within each level evolve. Goals and priorities may change as a result of shifts in ideologies or the increasing dominance of a particular ideology that gives rise to new policy goals and priorities. An example of this includes the transformation of various countries from closed economies to open economies as a result of emerging neoliberal and globalisation paradigms which led to the introduction of new policies (from privatisation and deregulation) to promote competition, efficiency and the reduced role of the government. Change can also occur for organisations, in the number of organisations (creation and reduction of organisations) and also in the responsibilities that they are assigned. This may be a result of changes to policy or rules.

A historical analysis of institutions enables the researcher to understand the evolution of different institutions and the influences of trends or factors. These factors may also explain how and why institutions change, what factors are likely to impact institutions as they have done in the past, as well as how the relationships between each level and between institutions of each sector have changed. This captures the dynamism of the EWF nexus. Reforms within the economy and each sector can be analysed and the relationships between EWF policies, rules and organisations, as well as the level of government involvement, can be identified at different points in time. The analysis of these historical dimensions can also reveal past problems and issues and the main influences which have shaped current day EWF policies.

The multiple-level analysis of institutions for governing EWF with an emphasis on understanding the extent to which institutions are integrated can provide insights into how institutional settings may need to evolve through an assessment of institutions over time. Understanding the need for change and the potential solutions is an important output of the application of this *Levels of Institutional Analysis* framework.

4.4 Conclusion

This research seeks to examine the extent of cross-sectoral governance of EWF, particularly where institutional settings allow for jointly governing EWF, incorporating considerations of the nexus between EWF. In support of this, this chapter completes the second objective of the research which is to propose a framework for developing an institutional perspective on the EWF nexus in the context of EWF security. Developing such a perspective requires an analysis of the institutions relevant to the governance of EWF. The proposed framework's focus on institutional settings for EWF is core to the development of an institutional perspective on the EWF nexus – the primary objective of this research. The framework proposed facilitates this analysis effectively as it includes the following features:

- The proposed framework is effective because it specifically addresses the question through its four levels of institutional analysis that defines relevant institutional levels and components where integration between EWF can be examined. The analysis of multiple level institutions that incorporates the influence of high-level institutions on low-level institutions demonstrates the application of institutional theory and its use for providing a structure to organise the analysis of the various components that comprise EWF institutional settings. The four levels represent a hierarchy: Level 1 institutions represent informal institutions, and Level 2, 3 and 4 institutions represent formal institutions. Level 1 institutions include development philosophies (economic, political, social, environmental), Level 2 institutions include the government, its characteristics and functions, Level 3 institutions include policies, rules and

organisations and Level 4 institutions include pricing processes and other sector-based arrangements.

- Further, the framework supports the development of a historical view of integration, allowing an assessment of the historical evolution of the institutions. Through such historical analysis, the framework enables the examination of how institutions evolve over the five periods of interest, capturing the dynamism of institutions. It also incorporates the analysis of changes in the broader socio-economic, political and environmental context which influence institutions. Its application for the analysis of institutions at the national and state levels is aligned with the scale of this research and enables a context specific view in accordance with different jurisdictions (e.g. states), further allowing for the comparison between them.

The proposed framework is therefore most suitable for this research as it maps directly to the question of whether institutional settings provide a means for incorporating EWF nexus considerations for redressing EWF security. In particular, it allows an assessment of the adequacy of current EWF institutions, providing insights that will essentially assist in the formulation of recommendations to improve institutions to better redress EWF security. Another contribution of institutional theory is the consideration that the degree of change to institutions is subject to the influences of higher levels. This consideration will help to ensure the effectiveness of recommendations.

The following chapters present the findings of the application of the framework to develop an in-depth country case study on Australia at both national and state levels. The analysis commences from early colonial developments to the present time.

Chapter 5 A Historical Overview of Energy, Water and Food Developments in Australia

This chapter provides a historical overview of EWF developments in Australia across five key time periods with a view to identify common trends and differences between EWF developments and to understand the broader interlinkages between EWF (EWF nexus). This chapter provides the context for the institutional analysis in the following chapters.

This chapter is divided into six sections. Sections 5.1 to 5.5 represent each key time period. Each section provides a broad description of the socio-political and economic context of the period, followed by a recount of the main developments in the EWF sectors, with an emphasis on identifying broader policy changes and government involvement. The time periods are:

1. Early Settlement and Colonial Development (from the late 1700s to 1900)
2. Federation, World War I and the Great Depression (1901 to the late 1930s)
3. World War II and the Post-war Economy (from the late 1930s to late 1960s)
4. Economic Reform, Globalisation and Environmental Awareness (1970 to the late 1990s)
5. Post-Reform Economy and Contemporary Challenges (2000 to the present)

These periods correspond with major developments in the socio-economic and political context of the nation, and these contexts have had a significant influence in shaping the EWF nexus.

Section 5.6 concludes the chapter.

5.1 Early Settlement and Colonial Development (late 1700s to 1900)

5.1.1 Socio-political and economic context

The period from 1788 to 1900 represents a time of colonial settlement in Australia's history entailing years of dispossession of the indigenous people and exploitation of the land. In 1788, the British settled in Australia, forming a British colony comprised of several penal colonies concentrated along Australia's coast. They proceeded with the forceful takeover of Aboriginal land, pursuing their economic interests in exploiting natural resources to support the colonies and the homeland.

The development of the colonial economy was an immediate priority to support the growth of the early settlements. The primary sector (agriculture, pastoralism and mining) played an important role in this development during this period. Australia was increasingly seen as a source of food exports for Britain (Fitzpatrick 1969) and during the early 1800s, economic growth was based on the production of wool and other commodities for British and European markets (Attard 2008). Exploitation of natural resources such as land, gold and other minerals in particular led to mining booms in the 1850s which contributed to rising income. The expansion of agriculture and local manufacturing attracted large amounts of British capital. By the 1850s, Australia's per capita Gross Domestic Product (GDP) was amongst the highest in the world (Madsen 2015).

The development of the country took place as a result of developments in the separate colonies which by 1864, included New South Wales (NSW) (1786), Western Australia (WA) (1829), South Australia (SA) including the Northern Territory (NT) (1834), Tasmania (1835), Victoria (1851), Queensland (1859) and the Northern Territory (1864) (ABS 1908, p. 54).

Population growth led to the formation of municipal and local governments in the mid-1800s (the first in SA) and soon afterwards, self-government systems were introduced, converting the colonies into states. The Australian Colonies Government Act 1850, enabled the colonies to establish their own governments and constitutions, with power given to governors and legislative councils. By 1890, each state had established its own constitution. State Constitution Acts were enacted in NSW in 1855, Victoria in 1855, SA in 1856, Tasmania in 1856, Queensland in 1859, and WA in 1890 (ABS 1908).

To foster growth, governments actively promoted immigration into the country (Wilson 2015). Throughout the 1800s, hundreds of thousands of immigrants arrived in Australia as a result of various government-funded migration schemes, the gold rush and rising economic conditions (Mence, Gangell & Tebb 2017). From 1788 with an estimated population of 859 persons, the population grew to almost four million by 1900 (ABS 1941, p. 521).

5.1.2 Developments in EWF

During this period, EWF were important matters for the colonial governments. By the 1850s, state and local governments shared responsibilities for EWF. Much of the focus for development during these years was to serve the interests of the colonies for which primary industries (agricultural, pastoral and mining industries), electricity and water were considered essential.

Energy

Earlier sources of energy during the period included wood and horsepower before the discovery of coal, gas, oil and the introduction of electricity, all of which depended on technological

advancement. Gasworks were established in major towns as a source of public lighting and where gas was not available, fuel from petroleum was used (Saddler 1981). Despite developments in energy, horsepower was still being used in the agriculture sector.

Mining was an important industry in the early development of the Australian economy. expanding massively in the 1850s as a result of the gold rush (Madsen 2015). The discovery of coal (first in NSW in 1797) brought in a large influx of the population, influencing the formation of various settlements (ABS 1908, p. 419). Mineral resource development was largely fostered by state governments through government assistance in accordance with various state Acts such as the Mining Development Acts 1896 in Victoria and the Mining Act 1894 in SA.

Electricity generation was introduced in the late 1800s with its development influenced by the distribution and the size of the population, industries and fuel and water resources. The first developments of electricity took place around the mid-1800s. In NSW, electricity experiments first took place in Sydney during the 1860s before it was commercially used in 1878. In NSW, the Tamworth Municipal Council was one of the first organisations to reticulate power for street lighting in 1888. In Queensland, electricity was first used in the government in 1883 and in 1897, the first electric tram was placed in service (ABS 1953).

Electricity systems developed on a local scale as transmission was not yet possible across long distances (ABS 1953; Butlin, Barnard & Pincus 1982). Electricity was predominantly a local issue needed to support the town for lighting, the development of electric trams and industrial consumption (Butlin, Barnard & Pincus 1982). While gas industries were mostly private, early developments in the electricity supply industry involved a mix of both private and public sector involvement including various private companies and local governments. The Perth Gas Company Limited in WA, the South Australian Electric Light and Motive Company Limited and the Electric Lighting and Traction Company of Australia were examples of private electricity companies (ABS 1953). Under various local council Acts, local councils were authorised to supply and sell electricity at prices which they determined, construct electricity works, and they also had regulatory powers. Electric Light and Power Acts were enacted in several states such as the Electric Light and Power Act 1896 in both Queensland and Victoria and the Electric Light and Power Agreement 1913 in WA, vesting powers over electricity with local councils. Much of the legislation was designed to provide standards of safety and to define the scope and obligations of the private organisations engaged in the production of electric power for sale (ABS 1953). In Tasmania, electricity supply was based on the development of hydro-electric power projects also with the involvement of local councils.

Water

During this period, the availability of water resources in Australia was a strong influence on the development of settlements, determining their potential size and density (ABS 1995, pp. 17-18). In turn, the patterns of water consumption impacted on the development of water resources. Similar to the electricity sector, water sector development including metropolitan water supply and sewerage and rural supply involved a combination of private and public interests, however public sector involvement was dominant through municipal councils and water boards.

In Victoria, waterworks and metropolitan water supply was the responsibility of the City Council, followed by the Commissioners of Sewers and Water and then by 1890, the Melbourne Metropolitan Board of Works. In Sydney, water supply and sewerage systems were under the control of local authorities, City Corporation, followed by the City Commissioners and the City Council. In NSW, Under the Country Towns Water Supply and Sewerage Act 1880 (NSW), municipalities were given powers to construct water supply, and sewerage systems where not serviced by the metropolitan authorities. In 1888 and 1892, two major water boards were established, the Metropolitan Board of Water Supply and Sewerage and the Hunter District Board, to administer and manage metropolitan water supply in their jurisdictions. In Tasmania, under the Rural Municipalities Act 1858, municipal councils were responsible for water supply, sewerage, irrigation and water conservation schemes. In Queensland, the Board of Water Supply was responsible for waterworks in the 1860s. Under the Water Authorities Act 1889, councils had power over water systems. Perth's waterworks, although first opened by a private company in 1890, was under the control of a water board under the Metropolitan Waterworks Act 1896 (ABS 1908).

State government involvement in water supply was also evident. For example, in WA, outside Perth, the Western Australian government was responsible for a number of waterworks including the Goldfields Water Supply. In SA, water supply and sewerage systems were constructed and maintained by the Engineering and Water Supply Department under the control of the Minister of Works for the Public Works Department.

Irrigation

The introduction of irrigation was a significant development in both the water and agricultural sectors. From the mid-1800s, the pursuit of agricultural expansion became increasingly limited because of Australia's highly variable climate and tendency to experience drought. Irrigation was seen as a solution to reduce the dependence of agricultural sectors on Australia's variable rainfall.

The development of irrigation systems began in Victoria assisted by the Chaffey Brothers from California, who during the 1880s established irrigation settlements (in Mildura, Victoria and in

Renmark SA. (ABS 1949). Victoria was the leader in the development of irrigation. By 1886, the government had implemented full-scale irrigation across the state

The challenges of dealing with the country's water variability led to government involvement in water development. This was seen in the Victorian Irrigation Act 1886, which vested in the government rights over water, authorised the construction of government works and enabled the provision of finance to support irrigation trusts (ABS 1949, p. 1098). The irrigation-related act influenced water developments in the rest of the country and soon similar legislation was enacted in other states.

Food

Agricultural and pastoral activity commenced almost immediately after settlement and was the prime focus for development. As early as 1787, Captain Philip was given instructions to 'proceed as soon as possible to the cultivation of soil' (ABS 1908, p. 298) for which grain and other provisions were to be secured. Early growth was to support the food needs of convict colonies (Greasley 2015) who were reliant on the government Commissariat for the supply of goods, money and foreign capital (Madsen 2015). In order to develop the agricultural sector, governments played an important role through land policy, financial assistance and the establishment of experimental farms and agricultural colleges.

Land policy was a key determinant in shaping the distribution of settlements and particularly in forming pastoral and agricultural industries (and also mining industries). Land legislation varied in each state and involved the allocation of grants, licences and leases to land to encourage farming and to ensure productive land use and also to control squatters (Madsen 2015). In most states, agricultural colleges and experimental farms were established to promote agriculture and improved agricultural practices. Government supervision of farmyard and dairy production by agricultural departments was also important, particularly to prevent the spread of diseases and pests. State governments also provided financial assistance to farmers through loan schemes to promote pastoral and agricultural activity and assist settlers in improving their land (ABS 1910).

Extracting and utilising natural resources became central to Australia's economic development during this period (Greasley 2015), where the rural sector was a key player. During this period, the development of agriculture produced wide benefits. While agricultural and pastoral activity was initially a means for sustaining the settlement population and meeting the immediate needs of the growing population (Attard 2008), agricultural and pastoral sectors soon became one of the main sources of economic growth, accounting for an overwhelmingly vast proportion of the country's exports. This was attributed to the abundance of land which was suitable for grazing

and cropping (Wilson 2015). Further, in the period, these sectors contributed to the country's high GDP per capita, comparable to the rest of the world (Madsen 2015).

5.2 Federation, World War I and the Great Depression (1901 to the 1930s)

This period, 1901 to the late 1930s, constitutes the formation of the Australian Federation (m1901) and the early emergence of the modern Australian economy of which EWF played important roles.

5.2.1 Socio-political and economic context

After years of discussion, conflicts and debate in the late 1800s, in 1901, and with the intention of resolving contentious matters, the self-governing states united to form the Federation of Australia, establishing a Federal system to characterise Australia's government (the Commonwealth government). Its powers and responsibilities were specified in the Australian Constitution and included a number of areas: taxation, customs, immigration, defence, banking and currency, certain public services, trade and other external affairs. States were responsible for all other unspecified powers, 'residual powers'. Their constitutions (enacted prior to the formation of the federation) were also allowed to remain, leaving the states with power over their own state and local matters.

The establishment of the Commonwealth government introduced a third level of government, in addition to the existing state and local levels of government. Power to make and manage federal laws was based on the separation of powers involving the three interacting groups, the Parliament to make and amend law, the Executive to implement the law, and the Judiciary to make judgements about the law.

During this period, a mix of political parties formed at the federal level, including the Protectionists and the Free Trade parties, Australian Labor Party, the Liberal Party, Nationalist parties, the United Australia Party and others. The political coalition at the state level often differed from their federal counterparts, thus foreshadowing difficulty in forming a consensus on matters of national interest.

The governments during this period generally followed protectionist policies to facilitate the development of Australia's domestic industries, including manufacturing and agriculture. Such policies emphasised import substitution and tariffs, e.g., the Customs Tariff (1902) and Lyne Tariff (1907) which aimed to support better wages.

In the federal structure, the scope for government intervention widened, and the government began to play a greater role in facilitating economic development. It assumed responsibility for providing large-scale infrastructure, such as railways and telecommunication. While the government was considered as a 'complement to the private sector' (Wilson 2015, p. 335) with the role of providing an environment conducive to private enterprise, its influence over the private sector rose during this period.

World War I had negative impacts on the Australian economy. GDP declined by almost 10% between 1914 and 1918, the labour force declined as a result of soldiers enlisting, and the costs of financing the war were high (Wilson 2015, p. 338). This led to greater government involvement and protective measures. Continued levels of high government intervention were important during the years and post-years of the Great Depression.

5.2.2 Developments in EWF

With responsibilities over trade and external affairs, the Commonwealth also came to play a part in EWF developments. EWF were, therefore, subject to three levels of government, the Commonwealth, state and local governments.

Energy

Since colonial settlement, the mining sector continued to be an important contributor to economic development. In the 1920s, both the Commonwealth and state governments provided financial and technical assistance to the mining sector. Commonwealth involvement intensified with the appointment of the Standing Committee on Liquid Fuels in the 1930s (ABS 1941), whose objective was to inform the government on the production of liquid fuels and substitutes and on obtaining independence in fuel supplies (ABS 1941, p. 321). Energy issues were of national concern and required high-level, national involvement.

During the period, the coal industry continued to develop, replacing the use of wood for energy; eventually, both were overtaken by oil in the 1920s (Saddler 1981). Steam power energy sources also helped to transform transport services in cities through railways and trams (Saddler 1981).

Early in the period, electricity developed at local levels in a decentralised manner, provided by private firms under the oversight of local governments. With technological constraints and high costs, there was little incentive to build costly transmission lines over long distances (Booth 2003) and to connect otherwise separate systems.

Legislation including Electric Power and Light Acts and other local acts continued to give power to local governments in all states to supply and sell electricity, construct and maintain works and regulate electricity. Councils were responsible for public lighting. In Tasmania, the state

government's Hydro-Electric Department established in 1914, unlike other states, had greater control over electricity systems.

After World War I, the electricity industry began to experience a trend toward public ownership. As a result, the electricity industry transitioned from mostly localised and decentralised control involving both private and public sectors, to a more centralised and regional control. Greater coordination and centralisation in the sector was a key feature of the electricity industry during this period. This process, however, varied according to each state.

The role of boards and commissions

The electricity sector began to experience greater coordination across dispersed electricity systems with the establishment of Boards and Commissions responsible for unifying electricity supplies in the states and legislation to support unification.

The centralisation of electricity systems occurred first in Victoria, with the establishment of the State Electricity Commission in 1919 which was vested with the control of the generation and distribution of electric power in Victoria, coordinating and unifying the electricity supply to all consumers and regulating the electricity supply industry (ABS 1953). In 1938, Queensland established its State Electricity Commission, also responsible for the generation and distribution of electricity. In Tasmania, the Hydro-Electric Commission was entrusted with the responsibility of centralising the development of electricity in the state, replacing the previous Hydro-Electric Department.

NSW, however, did not establish a State Electricity Commission until 1950, making it the last state with a large state body responsible for electricity. In WA, its State Electricity Commission was established in 1945. Up until then, the Western Australian Government, under the Government Electric Works Act 1914, was responsible for electricity with the power to construct works for the supply of electricity in the metropolitan area. In SA, electricity remained under private interests during the period.

Water

Water developments varied across states and reflected the differences in the climate, the distribution of water resources and the differences in water interests. For example, while Victoria and NSW were largely preoccupied with the development of irrigation to enable agricultural expansion in variable rainfall areas, SA's concern with water was related to protecting river transport. Tasmania was largely preoccupied with water-related developments of hydro-electricity, and in WA, water supply was important for mining as evident in the Goldfields Water Scheme.

In this period, three main developments in the water sector were evident. Firstly, the recognition of water as a 'transboundary' issue requiring Commonwealth intervention and intergovernmental coordination; secondly, changes to water rights and thirdly, increased centralisation and coordination of water systems that had originally developed locally via joint control between state boards and local governments, typically through the creation of special commissions and water boards. Irrigation continued to be of great importance, particularly to support pastoralists and the agricultural economy, enabling rural expansion. Irrigation was to enable cultivation in areas where agriculture and pastoral activity were at times unfeasible as a result of inadequate rainfall (ABS 1930).

Transboundary water issues

Water is essentially a transboundary issue as water systems are not confined to state borders. In the drafting of the Australian Constitution, water governance was one of the most contentious issues with debate about who should govern water and river use (Kildea & Williams 2010). Each state had its own competing objectives. For those states sharing the water sources of the River Murray, Victoria and NSW were preoccupied with irrigation while SA was preoccupied with protecting its river trade.

To address these concerns, two sections were added to the constitution, Section 98 and Section 100. Section 98 covered 'the power of the Parliament to make laws with respect to trade and commerce extends to navigation and shipping and railways the property of any state'. This meant that SA could be assured that, if needed, the Commonwealth could intervene and protect river trade, which was important to them (Kildea & Williams 2010). Section 100 stated that 'the Commonwealth shall not, by any law or regulation of trade or commerce, abridge the right of a state or of the residents therein to the reasonable use of the waters of rivers for conservation or irrigation'. Both sections recognised the multiple uses of water and the interests of states.

While Section 51, concerning powers of the Commonwealth, did not specify water as a matter to fall under its control, these sections allowed some scope for Commonwealth intervention in water matters to pass laws regarding river trade and to protect the multiple interests of states (*Commonwealth of Australia Constitution Act* 1901).

In 1915, the River Murray Agreement came into effect to empower the three states (Victoria, NSW and SA) to jointly manage River Murray. The River Murray Waters Act allowed for the construction of works and the distribution of water, including provisions for the use of water, and led to the establishment of the River Murray Commission (ABS 1949).

Given the need to recognise and coordinate the multiple interests of different water users across state and local levels with regard to sharing transboundary water resources, water governance became a challenge.

Water rights

By the early 1900s, governments had rights to control water use, representing a significant change to the water rights system that had existed during the settlement years which had been based on a riparian system of water use derived from British law which had developed from a geographical context that was significantly different to that of Australia (Kildea & Williams 2010; McKay 2005; Tisdell, Ward & Grudzinski 2002). Following Victoria's Irrigation Act 1886, states enacted similar laws allowing government control of water and subsequently, systems for allocating water rights were developed. With control over water, governments were in a better position to encourage agricultural production to pursue their other economic interests (NWC 2011a).

Control of water supply

During this period, the control of water supply and sewerage and irrigation varied across the states. In metropolitan areas of Sydney and Melbourne, water supply and sewerage were the responsibility of special Water Boards (Metropolitan Board of Water Supply and Sewerage in NSW and the Melbourne Metropolitan Board of Works in Victoria). In Adelaide, Perth and Tasmania, state government bodies were involved. For other cities and towns, water supply was the responsibility of municipal councils and water trusts. For these towns, both government and local councils could undertake waterworks construction.

In NSW, the Water Conservation and Irrigation Commission controlled a number of irrigation schemes and water works and was responsible for water supply, water trusts, flood control districts, issue of irrigation licences and farm water schemes. Under the Water Act 1912, the Commission had the power to construct as well as acquire and utilise irrigation works. In Victoria, water conservation works were mainly controlled by two organisations, the Melbourne and Metropolitan Board of Works (in control of metropolitan water and sewerage) and newly established State River and Water Supply Commission. Other waterworks were the responsibility of trusts or municipal corporations (ABS 1920). The State River and Water Supply Commission was the first of its kind in the water sector, established in 1905, under the Water Act to enable a state-wide approach to water management and irrigation.

Similar arrangements existed in other states where a main metropolitan body was responsible for metropolitan water supply, sewerage and drainage and a Commission body was responsible for irrigation with some states leaving local municipalities responsible for constructing water systems. In Queensland, such roles were played by the Water Supply and Sewerage Department of the Brisbane council and the Commissioner Irrigation and Water Supply. In WA, responsible

bodies included the Water Supply, Sewerage and Drainage Department and the Irrigation Commission in 1914. In NSW, responsible bodies included the Metropolitan Board of Water Supply and Sewerage, the Hunter District Board, the Commissioner for Water Conservation and Irrigation, replaced by the Water Conservation and Irrigation Commission. In SA, the responsibility for water and sewerage supply was vested with the Engineering and Water Supply Department of the Public Works Department.

Food

The years prior to World War I were characterised by significant growth. Australia expanded its export markets to Asia and the share of British exports had fallen (Lougheed 1988). Protectionist tariffs introduced earlier, e.g., Customs Tariff (1902) and the Lyne Tariff (1907) contributed to a trade surplus. Australia relied on the comparative advantage of its land-intensive sectors, mainly, agriculture and mining where prices were favourable. The main policy emphasis of the agricultural sector was on expansion to assist national development, to support the needs of the growing population and to increase export revenue (Edwards 2006 cited in Borland 2015)

Government assistance continued via loans to farmers and the establishment of agricultural colleges and experimental farms. Land policy also continued to shape agricultural and pastoral development. Various pastoral and agricultural land acts in the states continued to address issues related to land occupation, including the desire for 'closer settlement' aimed at breaking up large land holdings to put smaller land holdings into more productive use for cultivation. This was also to reduce the influence of powerful land-owners and occupiers.

The pursuit of economic development and growth and the need to endure World War I and the Great Depression gave rise to higher levels of government intervention in the agricultural sector. While primary industries contributed largely to Australia's economic prosperity and growth, they were also sensitive to external forces, dependent on the volatile demand and supply conditions of the world market for both agricultural and mining products. For Australia's export-driven economy, this was a disadvantage (Madsen 2015).

The agricultural sector in Australia was deeply affected by the post-war recovery and self-sufficiency policies abroad which meant declining demand for Australia's agricultural product and growing surpluses. This led to falling commodity prices, falling export revenues and a weakened capacity to import, thus further negatively impacting manufacturers. Overseas borrowing also became difficult as British loans were only for war and not for economic recovery.

The government responded with a range of domestic policies to overcome these circumstances. Government assistance was provided at both state and federal levels (Wilson 2015). Commonwealth government schemes, for example, replaced state agricultural schemes that were

not successful (Wilson 2015). While immigration policy after the war was seen as a means to boost the population and economy, assisted migration to relocate British migrants to farming land to contribute to rural production was largely unsuccessful (Wilson 2015).

Despite progress in recovery towards the end of the 1930s, Australia was impacted again by the beginning of World War II. Dependency on rural industries had exposed some weakness in the Australian economy which was influenced by external forces.

5.3 World War II and post-war economy (late 1930s to the late 1960s)

The period from the late 1930s to the late 1960s saw the Commonwealth government play an even greater role with increased centralisation of power at the federal level, impacting the evolution of EWF sectors.

5.3.1 Socio-political and economic context

Keynesianism development

The period from World War II to the early 1970s represents an era of Keynesianism characterised by a growing role for the government in economic affairs, including affairs of EWF. The role played by the Commonwealth government increased, particularly to respond to the threat of attack during the war. In the initial years of the war, resources (capital, labour) were strictly rationed and mostly diverted for military purposes (Wilson 2015, p. 346). Under the National Security Act 1939, regulations were implemented in a number of areas, including agriculture, to control production.

After the war and against the backdrop of 'a mistrust of the private sector'(Wilson 2015, p. 349) and scepticism of the private sector's ability to rebuild the post-war economy, confidence was placed in the government to lead reconstruction and steer the post-war economic development of the country (Wilson 2015).

The 1950s and 1960s were 'golden years' as the country experienced sustained economic growth (Lougheed 1988). A significant proportion of this growth was achieved as a result of rapid industrialisation and expansion in the manufacturing sector, supported by protectionist measures and strategies of import-substitution. By the early 1960s, manufacturing accounted for 27% of the total output (Lougheed 1988), however natural resource industries remained important sources of export revenue (Attard 2008). During these years trade links shifted away from Britain towards the Pacific, particularly Japan.

Australia pursued its long-term objective of full employment through highly interventionist policies (Attard 2008). Further, immigration policy became an important feature of Australia's national development efforts on the grounds that growth in population was necessary to achieve Australia's economic goals. The Migration Act of 1958 replaced the Immigration Restriction Act of 1901, commencing the transition towards a more culturally diverse country and an increased population away from its previous 'White Australia Policy' that dominated the first half of the century.

The Commonwealth government played an important role in post-war reconstruction, establishing new industries and new infrastructure projects, e.g., the Snowy Mountains Hydro-Electric Scheme. Further, these policies continued throughout the period, despite changes in government parties, demonstrating bipartisan support for the government's leading role in economic matters.

5.3.2 Developments in EWF

Energy

The post-war years were a time of expansion for the mining sector, and states had well-established mining industries. Governments maintained an important role in the sector with the responsibility of controlling mining and exploration, mineral rights and export (ABS 1949).

While the mining sector continued to be subject to state laws, 1940s saw instances of centralisation at a federal level, particularly with the establishment of new organisations aimed at dealing with problems of national importance and functions in relation to mining (ABS 1949). These organisations included the Australian Mining Council (1940), Minerals Committee (1941) and Mining Industry Advisory Panel (1944). In 1947, the Joint Coal Board was established by the Commonwealth and NSW Parliaments to regulate and assist the coal mining industry in NSW (ABS 1970a, p. 911). This demonstrated intergovernmental coordination between the Commonwealth government and the NSW government.

Between 1929 and 1949, the production of electricity increased nearly three-fold (ABS 1953, p. 1153). Despite this growth, after the war, electricity supply, however, was inadequate and all states resorted to power and petroleum rationing. This was attributed to restrictions of development programs during the war (ABS 1953). After the war, population and industrial growth contributed to greater demand for electricity and this led to several projects being established, for example, the Snowy Mountains Hydro-Electric Scheme, a hydroelectric and irrigation project to serve both NSW and Victoria.

Principal sources for electricity production during the period included coal, water and petroleum (ABS 1953) with coal playing a dominant role in all states except Tasmania which relied on hydro. Thermal power plants contributed to approximately 80% to 90% of electricity and hydro much of the rest (ABS 1953, 1970a). While black coal was important in NSW and Queensland, Victoria relied predominantly on its abundant brown coal supplies.

The years after World War II were characterised by an acceleration of nationalization and centralisation of electricity supply, a trend which started in the previous period, since World War I. By early 1960s, 'all major generating stations supplying the public were in varying degrees, under the control of the state statutory organisations, established to facilitate the coordination of electricity systems (generation and distribution) within the various states' (ABS 1970a, p. 949) Smaller rural supply organisations were gradually absorbed by the larger state authorities. By the end of this period, all states had a special Electricity Commission or large authority responsible for electricity generation and distribution, and the coordination and unification of electricity systems. In SA, this was the Electricity Trust of South Australia and in WA, this was the State Electricity Commission, both created in 1946 after the creation of their counterparts in other states. In 1950, NSW created its State Electricity Commission which operated alongside the Electricity Authority of NSW, responsible for planning, coordinating and regulating the electricity sector (ABS 1953). In NSW and Tasmania, these large authorities were responsible for electricity subsidies in rural areas to improve electricity access. The NSW Electricity Authority administered the Rural Electricity Subsidy Scheme to support rural electricity development (ABS 1948) and the Hydro-Electric Commission in Tasmania provided subsidies to farms (ABS 1970b, p. 393).

Gas industry development remained under private control although regulated by state legislation. In NSW, Queensland and SA, all gas production was private. In Victoria, the gas industry and the refinery and liquefied petroleum gas industry had a mix of public and private involvement. In 1967, the Victorian Government introduced Australia's first general pipelines enactment, the Pipelines Act, to support the development of gas pipelines. (ABS 1975).

Water

The control of water supply and sewerage varied across the states and their respective metropolitan and country areas, under the control of either special boards, commissions, government departments and or municipal councils. During this period, water issues continued to be managed at the state and local levels, however, the Commonwealth government also played a role. In addition to coordination between states, exemplified by the River Murray Agreement, an important area of Commonwealth involvement in the water sector was in the development of the Snowy Hydro project. The 1940s to the 1970s represented a period of water expansion. During

this period, a number of large-scale water infrastructure projects were commenced. As of 1969, thirty-six major dams and reservoirs were completed (ABS 1970a, p. 849). Irrigation also remained an important feature of the water sector.

After World War II, the states of NSW, Queensland and Victoria participated in schemes to assist farmers by carrying out water supply works. Supporting legislation included the Farm Water Supplies and Drainage Advances Act 1944 in Victoria, the Farm Water Supplies Act 1946 in NSW and the Farm Water Supplies Assistance Act of 1958 in Queensland (ABS 1948).

However, while water development was pursued aggressively during this period, there was increasing awareness about water-related environmental issues. These included soil erosion, salinity issues and other water use impacts with negative impacts on rural sectors.

In the early 1940s, initiatives to better coordinate and manage land and water resources were taken in all states. This was seen in Queensland with the establishment of the Bureau of Investigation under the Land and Water Resources Act of 1943 to coordinate the development of land and water resources; in NSW, with the Conservation Department established in 1944 to link the Water Conservation and Irrigation Commission, the Soil Conservation Service and the Forestry Commission and in Victorian with the establishment of an authority to control land use on catchments (ABS 1949).

Although states were to deal with their own environmental and water problems, increasing recognition was given to water as an issue of national importance. This gave rise to a greater role for the Commonwealth government in the area of water. In 1945, water conservation and the efficient use of water had become an important theme in rural policy, as seen in the reports by the Rural Reconstruction Commission for the Commonwealth government. The establishment of the Australian Water Resources Council in 1962 to aid in the planning for water development through the provision of comprehensive assessments on the country's water resources also marked greater centralisation in dealing with water issues at the national level (ABS 1970a).

Through special grants, the Commonwealth also supported water developments in the states. In 1966, the National Water Resources and Development Programme was introduced to support the development of water projects aimed at reducing the hazards of droughts and expanding primary production through the provision of grants to the states. From 1966 to 1969, grants amounted to approximately $150 million (ABS 1970a, p. 853).

In water supply and sewerage, there were few changes in governing bodies. In Tasmania, two new authorities were established, the River and Water Supply Commission (1957) and Metropolitan Water Board (1962) which were made responsible for water supply and sewerage of towns previously the responsibility of cities and municipalities. In WA, the Metropolitan Water

Supply, Sewerage and Drainage Board replaced the Metropolitan Water Supply, Sewerage and Drainage Department in 1963.

Food

High levels of government involvement was increasingly prominent in the rural sector. This further demonstrated the Keynesian ideal of government involvement, particularly in the economic management of these sectors. Since the 1900s, the protection of agricultural and manufacturing industries had been an important feature of the Australian economic policy.

Wartime food controls

In light of wartime defence powers, much of Australian agriculture became subject to government invention and the government implemented a number of measures to control the food supply. As described in the Year Book Australia 1944, 'it was not long before Australia for the first time in her history had to face the prospect of restricting her own food consumption in order to share her supplies with outer countries' (p. 922). The outbreak of war necessitated the safeguard of food supplies, ensuring the security of food in the case of the event of invasion, hostilities on the mainland and the potential disruption to transport systems. For example, in 1940, the Emergency Supplies Plan was adopted involving the placement of reserve stocks of food in all grocery stores throughout Australia and the establishment of special government stores for civil service use (ABS 1944).

Increased production and food control to support members of the armed forces and persons abroad were seen in relation to a number of food products. Expansion in potato and pork production was necessary in order to meet the rising demands of Australian and Allied Servicemen (ABS 1949). Furthermore, extensive developments in vegetable growing were undertaken, leading to large-scale development, increased mechanisation in the industry and the extension of production to new areas. In 1942, in response to rising demands for rice abroad, the consumption of rice in Australia was prohibited (except in the case of hospitals) and production was diverted to meet needs abroad.

A number of organisations to address food and agricultural supply emerged during this period. These included the Australian Food Council (established in 1942) responsible for 'a common national policy in relation to production and procurement of supplies' (ABS 1948, p. 412), the Production Executive and the Food Executive, which later took over the functions of the Food Council and the Commonwealth Food Control, created to address all problems of food production and supply and implement food policy (ABS 1948). A Director-General of Agriculture was appointed to coordinate agricultural activities of the states, followed by the Secretary of the

Department of Commerce and Agriculture who became Controller-General of Food and had special powers under the National Security Act 1943.

The overall direction of food policy was under the Production Executive and the Food Executive. The Food Control organisation was responsible for a number of areas: directing agricultural production, factory production, procurement of food, inspection of factories and foodstuffs, exports, and collaboration with the British Food Mission, United States army specialists, and marketing boards (ABS 1944). Other responsibilities included cooperation with states in the organisation of agriculture for the special purpose of war-time production (through the State Departments of Agriculture and the District War Agricultural Committees), the organisation of labour and the production and use of agricultural machinery.

In 1942, the War Agricultural Committee was established to deal with rural labour scarcity and rural production matters. District committees were to 'stimulate production and to ensure that efficient use was made of available resources of labour, machinery, fertilisers etc.' (ABS 1948, p. 412). From 1939-1945, the War Service Land Settlement Scheme was implemented to enable settlement on land by ex-servicemen from the war. This was supported by state financial assistance for capital expenditure and special loans and grants through the War Service Land Settlement Acts.

Post-war reconstruction

Agriculture was an important focus for reconstructing the post-war economy. In 1943, the Rural Industries Commission was established to inform planning of the sector on production, distribution and marketing of rural products as well as conservation of natural resources. From 1944 to 1946, a number of reports were published dealing with the factors affecting the rural economy, settlement of returned members of the forces, land utilisation, financial and economic reconstruction of farms, capital requirements and rural credit, farm efficiency and costs, rural amenities, irrigation, water conservation and land drainage, rural land tenure and valuation, and commercial policy in relation to agriculture (ABS 1948).The recommendations of the reports appeared 'much in tune with the attitude of the ministers and the governments' (Whitford & Boadle 2008, p. 544).

In 1946, the ministerial statement, *A Rural Policy for Post-War Australia* addressed recommendations given by the Rural Reconstruction Commission to promote agricultural and pastoral industries and full employment. The statement dealt with issues of living standards and general welfare in the primary industry, production for domestic and export markets, prices, natural resources (water and soil) and conservation, raising farm efficiency and in particular stabilisation schemes and organised marketing (Commonwealth of Australia 1947).

Emphasis continued to be placed on protective measures and almost all rural industries across the states were subject to some form of specifically targeted government intervention, control and assistance. Statutory marketing arrangements were an important feature of government intervention which involved stabilisation schemes and organised marketing. Stabilisation referred to price stabilisation policies that involved the pegging of prices and wages through subsidies and guaranteed prices through the imposition of price ceilings and floors. Guaranteed prices included two price schemes for home consumption and export. They were a means of protecting farmers' incomes and assisting producers during times of uncertain and fluctuating overseas prices (Industry Commission [IC] 1991c). Organised marketing arrangements involved the production controls, acquisition, pricing, sale and disposal of rural products (Butlin, Barnard & Pincus 1982, p. 33). Statutory marketing authorities (SMAs) such as special boards (e.g. Australian Wheat Board) were created at both Commonwealth and state levels to control the marketing of each product overseeing such arrangements.[9] Special rural banks were also established to administer agricultural loans to farmers.

Other forms of government assistance typically involved bounties (agricultural tractor bounty), subsidies (fertiliser and other inputs), trade controls including international agreements in certain commodities, production controls, tax concessions, credit, drought assistance and financial assistance to agricultural research and extension services (Gray, Oss-Emer & Sheng 2014; McKay 1965, p. 33). Farmers were also compensated for the effects on farm input costs of protecting manufacturing industries from import competition (Gray, Oss-Emer & Sheng 2014 cites Martin 1989).

Through its active protection of rural industries, the government played an important role in fostering rural expansion and to promote economic development. However, economic development was not the sole reason for protection. It was also due to the concerns of the welfare of farmers and their families. Botterill (2016) discusses the cultural aspect inherent in Australia associated with the deep and cultural attachment that the Australian community had with farming. The author describes the perception of farming as a special activity, with sympathy for farmers and the family farm. These values contributed to, what was considered, 'unquestionable levels' (2016, p. 669) of support for government assistance. This connection permitted ongoing support and protection of the agricultural sector. Botterill (2016) cites (Skogstad 1998) calling this as 'agrarian exceptionalism'. The author states,

[9] Further details of agricultural industry assistance are provided in Appendix B.

> *'Attachment to the family farm as the backbone of the industry, and the central role that agriculture retains in Australian folklore and the national self-image, suggest that agrarianism has an influence on the efficacy of agricultural policy'. (Botterill 2003, p. 5).*

The symbolism of Australian agriculture is also discussed by Hughes-D'Aeth (2018, para. 2) as a '…religion' as much as it is an 'industry'. The connection to the land through agriculture had brought a sense of unity and is something that Australians have identified with. It is such romanticism with agriculture that the author attributes detrimental impacts on the environment to. Years of exploitation of land and interventions such as the introduction of new species, have broadened negative outcomes, e.g., extensive land clearing and salinization. From this perspective, the unsustainability of agriculture is highlighted, not only the industry itself but in the context of the values that Australians place on agriculture - That the reality of ancient soils, frequent bouts of drought and water scarcity and degraded land is incongruous with the aspirations of Australian agriculture that continue to demand more from the environment, perhaps causing further damage.

5.4 Economic reform, globalisation and environmental awareness (1970s to 1999)

The period from the 1970s to the end of the 1990s represented a significant transformation of the Australian economy including EWF sectors, in accordance with the precepts of neoliberalism and globalisation. This period is characterised by a shift away from the ideals of high government intervention in the economy to that of low levels of intervention, exposure to competition and faith in market forces to bring about improved economic outcomes. Another feature of this period was heightened environmental awareness arising from worsening environmental problems, for example, water quality and land degradation (national level), and global warming and climate change (global level), with greater attention to national environmental policy. Since the 1970s, the need to address environmental problems had become an important consideration in the Australian economic policy.

5.4.1 Socio-political and economic context

After the economic growth experienced in the 1960s, in the 1970s, economic concerns began to emerge. These included inflationary pressures brought upon by mining booms, low productivity, oil crises, rising wages and high levels of government spending adding to pressure on the federal

government budget and worsening of the balance of payment account (Fenna 2013). These problems were attributed to the protectionist policies of the earlier years.

To address these problems, the Liberal and Labor governments implemented a number of economic policies during this period aimed at removing protections. These included an across the board 25% reduction in tariffs in 1973, inflation targeting, wage decentralisation, deregulation of financial markets**,** the floating of the Australia dollar shifting towards market-determined exchange rates and a system of microeconomic reforms aimed at addressing the structural issues of the economy (Keating 2015; Kelly 2000; Otto 1997).

These policies essentially involved a winding back of the government interventions of the previous period, replacing them with market-based policies that emphasised greater competition, corporatisation, privatisation and restructuring of publicly owned enterprises, including the elimination of government monopolies and the deregulation of infrastructure sectors like energy, transport and telecommunications (Attard 2008; Productivity Commission [PC] 1999). Further, these reforms were implemented in various sectors, including manufacturing, government, finance and EWF-related sectors. The main objective of these reforms was to improve the economy's efficiency and productivity. Economic reform, both macroeconomic and microeconomic, was a key feature of this period, led by the Commonwealth government to transform the economy. It corresponded with similar moves underway in Britain and the USA.

Both the Commonwealth and state governments implemented these reform measures, though at first, unilaterally and at different times and speed, leading to significant variations in progress across states. Intergovernmental coordination was further enhanced by the establishment of the Council of Australian Governments (COAG) in 1992. In 1995, influenced by the Hilmer Report in 1993, the Commonwealth government introduced the National Competition Policy (NCP) and established the National Competition Council to provide greater coordination of economic reform. The Commonwealth government played a key role in facilitating reforms through incentive payments to participating states (Banks 2005; PC 2005). The NCP built upon the successful outcomes of the Trade Practices Act 1974 in the promotion of competition. By the early 2000s, most of the main reforms had been initiated and the Australian economy had transformed into a market-based economy in complete contrast with the immediate post-war economy. Aside from economic developments, a number of policies aimed to improve social, welfare, and environmental outcomes were also introduced during this period (Keating 2015).

In the 1970s, focussed action to address environmental issues was evident as environmental policy became part of the political agenda. In 1972, for example, the Australian Environmental Council was established and in 1974, the first pieces of environmental legislation (Environmental Protection Acts) were enacted, particularly leading to the introduction of environmental impact

assessments. Other achievements included: National Conservation Strategy (1984); the formation of the Australian and New Zealand Environment and Conservation Council (ANZECC) (1991) to provide a forum of consultation, cooperation and liaison on matters concerning the environmental management, pollution control and conservation (ABS 1990, p. 375); signing of the Intergovernmental Agreement on the Environment (1992) to support intervention in environmental issues and to set out cooperative arrangements on a number of specific environmental issues; National Strategy for Ecological Development (1992) to reflect the recognition that 'in pursuing material welfare, insufficient value has often been placed on the environmental factors that also contribute to quality of life' (ABS 1994, p. 440); commencement of environmental reporting with the State of Environment Report (1996) and the enactment of the Environmental Protection and Biodiversity Conservation Act 1999 (ABS 1994).

During the period, global warming and climate change became an important issue. Given Australia's historical dependence on fossil fuels to meet domestic energy needs and as a key source of export revenue, the implementation of climate change policies has been politically challenging. The environmental concerns however provided impetus for an accelerated introduction of renewable energy with implications for the water and food sectors.

5.4.2 Developments in EWF

EWF developments during this period are characterised by a centralisation of policy-making at the national level, including policies to reform EWF sectors. The overall objective of these reforms was to improve the productivity and efficiency of these sectors through the introduction of competition, deregulation and privatization.

The nature of these reforms varied across the EWF sectors and further, reforms commenced at different times. For example, reforms in agriculture started in the early 1970s. For the energy sectors, major reform in electricity industries started in the 1990s, although state reforms were implemented during the 1980s. In gas industries, reform started in 1991 and in mining industries, economic reform started earlier in 1986. Water sector reforms commenced in the 1980s at the state level and in 1994 continued under a national approach with the COAG Framework for Water Reform (IC 1998).

Energy

In the 1970s, Australia, like many other countries, was having to respond to global oil crises (1973 and 1979) affecting its economy and the energy sector (Borland 2015). Australia was a major oil importer and as a result, suffered from a decline in energy security. With the onset of oil crises, Australia's dependency on oil became an important issue for the Commonwealth government,

with its responsibilities over the trade of fuels. In the 1970s, the main policy objective was to reduce dependency on imported energy, to improve self-sufficiency to a 'justifiable level' (McHugh 1981, p. 804) and to change the energy base to one that was less dependent on liquid fuels. It also sought to restrain the consumption of energy, particularly liquid fuels (Department of National Development [DNP] 1979). Energy policy focussed on three key areas, namely, pricing of oil, conservation of energy (liquid fuels used in transport) and inter-fuel substitution, particularly promoting the use of coal as a substitute for oil and liquid fuels (McHugh 1981). In 1978, the Commonwealth government introduced full import parity to refiners for all indigenous crude oil (DNP 1979) and by introducing a production levy and allowing prices to rise, it sought to encourage conservation, substitution and exploration of oil. Expanding and diversifying the country's energy resources was key to addressing energy security issues at the time. On the demand side, national energy conservation campaigns were developed, including measures such as voluntary fuel economy standards for motor vehicles, fuel savings in government departments and agencies and a conservation publicity scheme (DNP 1979, p. iii). In 1979, Australia became a member of the IEA.

In 1988, the Department of Primary Industries and Energy released the first national energy policy paper, *Energy 2000 – A National Energy Policy Paper*. According to Marks (1989) '…there had been no comparable official statement of Australian national energy policy', hence it was the first of its kind. The policy paper set out a guide for Australia's energy policy towards the year 2000. The key objectives included: security of overall energy supplies, development of exports in the energy sector and greater efficiency in the domestic energy sector.

As the relative importance of petroleum in the energy mix reduced (Department of Primary Industries and Energy [DPIE] 1988), *Energy 2000* expressed new attitudes to those held in the 1970s. For example, by the late 1980s, self-sufficiency was no longer a major goal. Further, from a focus on liquid fuels in the 1970s, energy policy now adopted a broader approach, considering overall energy security and the energy sector contribution to economic goals. The policy also provided a 'new' conceptualisation of energy security, suggesting that energy security no longer meant self-sufficiency in petroleum or in other types of energy. As stated,

> *Rather it is more of a concept of relative assurance and dependability of overall energy supplies in foreseeable circumstances, within an economic regulatory and consumption framework which is acceptable to the Australian community. Within that framework, an appropriate degree of security can be established, striking a balance between bearing the risks of supply inadequacies as they are perceived from time to time and the economic costs of trying to attain particular degrees of energy. (DPIE 1988, p. 1.6)*

The policy acknowledged the trade-off between the cost of providing energy security and extent to which energy security was to be provided. Energy conservation and diversification of energy continued to be key objectives of energy policy to augment energy security to ensure 'flexibility and responsiveness' (DPIE 1988, p. 1.7). The country furthermore was in a position to develop its energy exports.

Efficiency was another important goal which concerned the need for energy supply industries to cut production costs, raise productivity, improve business operations and financial performance as well as ensure prices give appropriate signals. In 1988, the government, after being previously involved in setting prices, deregulated the oil market. This represented a major step towards competition and efficiency in the petroleum industry (DPIE 1988).

The *Energy 2000* policy reflected a shift towards addressing internal issues within the domestic energy sector in contrast with the previous policies of the 1970s that focussed on managing external impacts related to oil insecurity brought upon by oil shocks. In the 1980s and early 1990s, this shift was consistent with and representative of the growing momentum of microeconomic reforms and government-led transition of the wider economy. This was reflected in the objective of efficiency in the domestic energy sector, as highlighted in the energy policy. By the 1980s, reforms began to be implemented in electricity and gas sectors, centering on introducing competition in the sectors with a view to improve efficiency, lower prices and provide better services. Similar (electricity) reforms were also being implemented across the world.

Energy reform

In the early 1990s, concerns had emerged that the energy sector was inefficient and not realizing its potential. Issues included excess capacity and over staffing, both resulting from poor investment decisions, high costs, pricing inefficiencies with tariffs not reflecting the cost of supplying to different users and cross-subsidisation (ABS 2000; Borland 2015; IC 1991a; 1991b).

Microeconomic reforms sought to resolve these issues. Prior to the 1990s, almost all electricity industries were government-owned. The private sector, however, ran major parts of the gas industry. Both electric and gas industries, private and public, were subject to extensive government regulation (IC 1991a). Reliance on available government finances by government businesses in the sector prevented prudent investment decisions. Starting from the late 1980s, reforms in the sector included administrative reform involving changes to the regulatory environment (IC 1991a, p. 3) and the corporatisation and commercialisation of public-owned utilities to increase their operational efficiency. By 1997, almost all electricity entities were corporatized and in the case of Victoria, privatised (Roarty 1998). Many of the existing entities were restructured from wholly state-owned vertically integrated monopolies into functionally unbundled generation, transmission and distribution, and retail entities. Competition was

introduced in generation and retail, with customers given the option to choose their suppliers (Roarty 1998, p. 2). Access arrangements were developed for regulated network services. In the gas industry, in addition to vertical separation, reforms also focused on the development of free and fair trade, an integrated national pipeline grid and introduction of access to pipelines. This involved the removal of all legislative and regulatory constraints to trade in gas and the introduction of a uniform framework for access to gas transmission pipelines (ABS 2000, p. 512; IC 1995, p. 56).

Progress varied across the states. In 1995, energy reforms were extended under the NCP, introduced to coordinate reform under a national approach. This reflected an enhanced role for the Commonwealth government. In the same year, the National Electricity Market (NEM) linking electricity systems of NSW, Victoria, SA and then later Queensland and Tasmania was established.

Water

Since the early 1970s, the water sector has undergone substantial changes, including water sector reforms. Like the energy sector, the water sector too saw greater involvement of Commonwealth government and policy-making at the national and inter-governmental level.

The 'drought-proofing' (Tisdell, Ward & Grudzinski 2002), 'build and supply' (Doolan 2016), 'developmental paradigm' (NWC 2011a) features of the water sector, continued to characterise the sector into the 1970s. In the 1970s, a number of water works (dams, reservoirs, weirs) were constructed including the Snowy Hydro Scheme in 1974. Between 1972 and 1981, more than 75 large dams were completed, supporting urban water supplies, irrigation districts, hydroelectricity, flood protection and recreation (Australian Water Association [AWA] 2012, p. 13).

By the mid-1970s, water issues including water quality, salinization, pollution, treatment of water supplies and the cost and technology of water re-use received national attention (ABS 1980, p. 393). From 1975, the Commonwealth government, in cooperation with the states began to produce a series of policy statements for national water management, for example, the statement by the Australian Water Resources Council in 1975 and two Commonwealth Policy Statements in 1979 and 1984.

The *Australian Water Resources Policy Statement* of 1975 set out basic principles, goals and underlying approaches to develop and manage water resources in Australia. It recognised the importance of water resource management as part of the broader framework of economic, environmental and social planning and proposed ten goals, namely, the adequate provision of water, both in quantity and quality, and the development and management of water resources, waste water treatment, water pricing, costs of pollution, flood land zoning, public education and

community involvement in planning and management (ABS 1976, p. 868). The second Statement (1979) was in response to a Senate Inquiry regarding the Commonwealth's role in water resources and the third (1984) included recommendations in response to the government-commissioned report, *Water 2000*, on Australia's water resource needs and problems to the year 2000. The water report released in 1983 addressed a number of issues facing the water industry. These included protection and improvement of water quality, efficient use of water supplies, conservation, appropriate allocation and financial policies, co-ordinated management and use of water and land resources, adequate provision for instream uses, improvements in data collection and analysis and information dissemination, provision of adequate funding for water resource purposes including research, and continuing Commonwealth government involvement (ABS 1985a, p. 321; Green 1983). The Commonwealth government continued to provide financial assistance to the states under the National Water Resources Development Program (1978) and the Federal Water Resources Assistance Program (1984). Funds were meant for a range of purposes including: water resource development or management activities and projects for agricultural, urban or industrial purposes, floodplain management, collaborative information programs, salinity reduction and land drainage, state-wide and broad regional water plans, and public education.

From the 1970s onwards, water policy became a key issue at the Commonwealth level. During the period, water management issues were approached with increasing intergovernmental cooperation between the states and the Commonwealth government. The management of the River Murray which expanded to the management of the Murray-Darling Basin (MDB) during the period, is an example of this.

Water reform

By the 1980s, the need for reform in the water sector became increasingly evident. The development-oriented phase of the water sector, characterised by unlimited grants of water entitlements without an understanding of water resource limits, substantial government investment in rural and urban water infrastructure without cost recovery and limited emphasis on environmental protection, led to unsustainable practices and use of water and pricing of water services below their cost (Doolan 2016; PC 2017b).

The focus on development and expansion and the neglect of environmental considerations led to a range of serious issues, e.g., closure of the River Murray Mouth in 1981, excess salinity in River Murray, toxic algal blooms and deteriorating river and wetland health (PC 2017b). Government debt from infrastructure investments, financially unstable water authorities, inadequate drinking water quality and services and inefficient irrigation were also serious concerns (Doolan 2016). Limited constraints on water allocation meant that water was overused, causing the sector to

become unsustainable and the high cost of improving infrastructure made governments unwilling to spend (NWC 2011a, p. 33).

In response to these emerging concerns, reforms to the water sector were undertaken. These reforms were implemented unilaterally (by each state) and involved changes to pricing towards usage-based tariffs, water rights with the introduction of tradeable water entitlements, and similar to energy sector reforms, the corporatisation and commercialisation of several water entities. While the previous decades focussed on the supply side of water, particularly expansion of the volume of water, many of these reforms sought to address demand-side issues. New pricing systems were introduced in almost all states during the 1990s. Water rights trading systems were introduced in SA in 1982, in NSW in 1988, Queensland and Tasmania in 1989, and Victoria in 1989 (IC 1998).

Towards the mid-1990s, the need for nationally coordinated water reform was felt (Doolan 2016). In response to this, the COAG *Water Reform Framework* was introduced in 1994, established to 'halt degradation of water resources and improve efficiency and sustainability in the water industry' (COAG 1994). The principles proposed by the framework included: pricing reform based on consumption-based pricing and full-cost recovery, reduction or elimination of cross-subsidies and making subsidies transparent, clarification of property rights, allocation of water to the environment, the adoption of trading arrangements in water as well as institutional reform and public consultation and participation. With the introduction of the National Ecologically Sustainable Development Strategy (1992), environmental considerations also shaped the development of the new water framework. According to Doolan, (2016), water reforms in Australia were based on four key areas: the transformation of water allocation, environmental management, reform of pricing water services and the modernisation of institutional arrangements.

In 1992, the *National Water Quality Management Strategy* was introduced in response to overall concerns regarding water quality. Its objective was, 'to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development' (Agriculture and Resource Management Council of Australia and New Zealand [ARMCANZ] & Australia and New Zealand Environment and Conservation Council [ANZEC], 1994a, p. 4).

During this period, the Commonwealth government played a leadership role in evolving water reforms, for example, promoting cooperation between the states and garnering support from a number of intergovernmental organisations, e.g., the Council of Australian Governments (COAG), the Australian and New Zealand Environment and Conservation Council (ANZEC), and the Agriculture and Resource Management Council of Australia and New Zealand

(ARMCANZ). This period showed a marked elevation of water policy efforts at the national level, in the backdrop of a recognition of the importance of coordination in water governance.

Food

Agricultural reform

Reforms in the agricultural sector were implemented in line with the broader economic reforms commencing in the 1970s, earlier than reforms in energy and water. Starting with an overall tariff reduction (although this affected the manufacturing sector more than the agricultural sector), there was a gradual decline in government intervention and assistance. Governments sought to limit the amount of financial assistance provided to the sector as levels of protection became too costly (Gray, Oss-Emer & Sheng 2014). From the 1970s, protective arrangements that had existed in previous periods were being dismantled and phased out.

Agricultural protection contributed to inefficiencies in the sector. As described by Gray, Oss-Emer and Sheng (2014), as the levels of protection varied across different industries, farmers would shift their resources to volatile but protected industries rather than away from them. There was no incentive to participate in more efficient industries where fewer gains could be obtained compared with what could be gained in a protected industry. Further, there was no incentive for them to improve their farming practices and importantly to manage their risks, particularly those associated with drought. Drought policies provided for income compensation as a result of drought which was considered a natural disaster. Further, farmers were not encouraged to implement strategies to manage droughts. This changed with the *National Drought Policy* (1992) which excluded droughts from natural disaster assistance. Protection in the agricultural sector had caused inefficiencies (mal-use of resources, particularly precious land, and more importantly, water) and this contributed to Australia's lack of competitiveness.

Since the 1970s, the focus has been on improving the performance of the agricultural sector. One important feature of the period was the Rural Reconstruction Scheme in 1971. This scheme represented a shift away from protection towards the gradual exposure to both internal and external competition. As part of the scheme, governments provided support for transition, encouraging farmers who could no longer be economically viable in the long term to exit and facilitating their exit as their resources shifted to industries that could continue to perform and operate rural businesses. In 1976, the Rural Adjustment Scheme, replacing the Rural Reconstruction Scheme, was implemented with the provision of adjustment financial assistance to producers who could demonstrate long-term viability in the industry.

By the 1990s, many of the statutory marketing authorities were dismantled. As a result, rural industries were gradually exposed to market forces. Fixed pricing was soon abandoned and

reforms took place in a number of rural industries (IC 1998). For example, the wheat industry was deregulated and by the end of the 1990s, the Australian Wheat Board was privatised.

In the late 1980s and 1990s, most attention was placed on enhancing the competitiveness of the sector, both domestically and internationally. Changes to agricultural policy also arose from the scrutiny of policies. As Botterill (2003; 2016) describes, the (political) nature of agricultural policy up until the 1970s was ad-hoc, based on an industry-by-industry approach dictated by industry interests that were often represented by Country party members in government at the time. In 1974, the Industries Assistance Commission was established to investigate the need for assistance. The body replaced the Tariff Board, responsible for administering the governments' protectionist policies. By the 1980s, the National Farmers' Federation (NFF), which was formed to represent the interests of farmers for protection, in light of the creation of the Industries Assistance Commission, had begun to support freer markets in agriculture. Both government and industry supported such changes in agricultural policy (Botterill 2003).

International trends also stimulated changes in the agricultural sector, for example, the shift towards neoliberalism in the agricultural sector was also partly due to 'pressure to abandon protectionist and interventionist policies in favour of market-oriented neoliberal alternatives' (Coleman & Skogstad 1995, p. 244) for the General Agreement of Tariffs and Trade. International trade agreements sought to lower barriers of trade in a number of areas, promoting the liberalisation of agricultural trade.

Food regulation and standards

Food regulations and standards represent an important part of ensuring food security for which governments have also played a role since the 1800s. The sale of food and drugs was under the control of local governments and numerous food laws have been enacted to regulate food products. e.g., the Victorian Pure Food Act of 1905, the first overall food Act developed in Australia. Food was also seen as a public health matter, under the responsibility of the National Health and Medical Research Council (NHMRC) (established in 1936). By 1953, NHMRC commenced the development of uniform food regulations (Food Regulation Secretariat 2018; Polya 2001).

Prior to 1975, the states were responsible for food safety. During the period, food standards and regulation became centralised, as seen in the involvement of national and international organisations (National Food Authority, Australian and New Zealand Food Standards Council) and the development of national food regulations and standards. In the mid-1990s, the Treaty between Australia and New Zealand to establish a system for the development of Joint Food Standards came into force to help harmonise food standards, reduce compliance costs and remove regulatory barriers to trade in food.

Also reflecting the importance of nutrition was the *National Food and Nutrition Policy* in 1992. Its ultimate goals was to '…to improve health and reduce the preventable burden of diet-related early death, illness and disability among Australians' (Department of Health, Housing and Community Services 1992, p. 12).

This period was also reflective of the use of intergovernmental forums for the development of national regulations and policy. The period marked a time of important changes in the food sector, both in terms of developments in the agricultural sector and its progressive liberalisation and in developments in food regulations and standards.

5.5 Post-reform economy and contemporary challenges (2000 to the present)

5.5.1 Socio-political and economic context

This period represents a quasi post-reform era, several years after initial reforms were implemented. Australia commenced its transformation towards a market-based economy, achieving a shift in the development path of the country. Efforts during this period have been to complete the reform process, improve upon the progress made, and address undesirable outcomes.

This period witnessed a new set of challenges, e.g., the Global Financial Crisis (GFC) and climate change and rising inequities. Efforts to redress these challenges have continued to shape the policy landscape of the period. The increasing complexity of the socio-economic context of the present times (e.g., changing global power structures, rising economic inequities, heightened climate change concerns and rapid technological advancement) continue to define the settings for the evolution of EWF sectors.

In the context of Australia, EWF policies reflect the broader socio-economic and environmental goals, geared towards facilitating greater economic growth in an increasingly competitive global economy. In recent years, the Australian Commonwealth and state governments put forward a number of plans for EWF sectors, for example, the *Mandatory Renewable Target* (2001) which sought to incentivise the uptake of renewable energy by electricity, *National Plan for Water Security* (2007), *National Food Plan* (2013) and agreement under the Paris Accord (2015). The country's overall climate policy, however, remains unclear and this is because of the challenges to integrate energy policy and climate policy (Warren, Christoff & Green 2016).

5.5.2 Developments in EWF

Although the reforms of the previous period achieved some desired results, further actions were recommended. These included: market development of the National Energy Market (NEM);

consolidation of water reforms under the *National Water Initiative* (NWI) paving the way for the first overarching piece of Commonwealth water legislation, the Water Act 2007; and further changes to statutory marketing authorities and a reduction in agricultural assistance. National policies, including the various energy white papers, the NWI, the *National Food Plan* and the *Agricultural Competitiveness White Paper* demonstrated the Commonwealth governments' involvement in the sectors.

EWF sectors face a variety of challenges, for example, energy security concerns associated with unreliable supply and rising energy prices, water shortages and the impacts of climate change affecting all sectors.

Energy

The energy sector continues to experience rapid changes and several factors continue to shape the direction of energy policy and hence energy sector development. These have included: energy security, once synonymous to oil security, now associated with reliability, affordability and availability of resources not exclusive to oil, market reforms, and environmental considerations largely, climate change and the need to reduce emissions. Emission reduction policies have focussed on renewable energies, energy efficiency and energy productivity while other contentious policies have involved carbon pricing, carbon taxing and emissions trading schemes. The period up to the present reflects a time of further market reform, energy policy making at the national level, greater involvement by the Commonwealth government, intergovernmental cooperation and the development of climate change policy.

Energy policy

In 2001, the COAG put forward the *National Energy Policy Framework* based on a number of goals concerned with the efficient provision of reliable, competitively priced energy services; the responsible development of energy resources, the exploitation of export markets and the mitigation of environmental impacts, setting the scene for energy policy for the period. Further reforms in governance, economic regulation, transmission, user participation and greenhouse gas emissions, however were recommended (Ministerial Council of Energy 2003). The implementation of these reforms was supported by the Australian Energy Market Agreement which was signed by all state and territories in 2004. The main objective agreed upon was to 'promote the long-term interests of consumers with regard to the price, quality and reliability of electricity and gas services' (p. 6). Under the agreement, all states were to enact the implementation of legislation to enforce the agreement.

A number of national-based organisations were formed to suport energy policy: the Ministerial Council of Energy (MCE) and its successors, Australian Energy Market Commission (responsible

for rulemaking and energy market development) and the Australian Energy Regulator (responsible for regulation). In the following years, reforms continued based on improving market contestability and efficiency, market governance, regulatory adequacy and the further development of the national system.

During this period three energy policy white papers were released, the first in 2004 during the Howard Liberal government, the second during the Gillard Labor government in 2012 and the third during the Abbot Liberal government in 2015. Each policy continued to support the goal of reliable and competitively priced energy, energy exports as well as further energy reform which continued to be a common theme over the period. Mitigating climate change goals, however, was more evident in the Howard and Gillard policies than the most recent Abbot policy. Supporting climate change action, the Labor Gillard government also put forward its *Clean Energy Future Plan*, which focussed on renewable energy, energy efficiency and carbon pricing. In addition to energy white policies, a number of policies have been implemented since. These have included the *National Strategy on Energy Efficiency* (2009), *National Energy Productivity Plan* (2015) and the *Domestic Gas Strategy* (2015).

Climate change action

Climate change measures were closely tied to energy sector developments. One important feature included the imposition of renewable energy targets. The first, *Mandatory Renewable Energy Target* (MRET), was introduced by the Howard Liberal government in 2001. The target sought to foster the uptake of renewable energy and was supported by the Renewable Energy (Electricity) Act 2000, imposing a legal requirement on electricity wholesalers to purchase renewable energy-generated electricity. The target was to source 9500 GWh from renewables by 2010, which reflected a 2% increase in the share of renewable electricity (IEA 2001). In 2007, the Rudd Labor government ratified the Kyoto Protocol, signalling the country's commitment to emissions reduction and during his term, in 2009, the MRET was replaced by the *Renewable Energy Target* (RET) and was increased to 20% of electricity from renewable sources by 2020 and this represented a target of 45 000 GWh (IEA 2012, p. 73; Talberg, Hui & Loynes 2015, p. 15). In 2015, the RET was amended to 33 000 GWh, now an estimate of 23.5 % of electricity generation for 2020 (Talberg, Hui & Loynes 2015, p. 23).

In attempts to progress emissions reductions, the Gillard Labor government introduced carbon pricing in 2011, supported by the *Clean Energy Act 2011*. Following its unpopularity, it was soon repealed by the succeeding Abbot Liberal government, who instead replaced the measures under the *Clean Energy Future Plan* with an alternative carbon emissions policy, the *Direct Action Plan*, featuring the Renewable Energy Target and in particular the *Emissions Reduction Fund* (ERF) which sought to subsidise the reduction of emissions through eligible means. This was

supported by the Carbon Farming Initiative Amendment Act in 2014. In 2015, the Paris Accord was adopted, the first legally binding climate change agreement. Australia set a target to reduce emissions by 26-28 % below 2005 levels by 2030, building on its 2020 target of reducing emissions by 5% below 2000 levels. Current climate policy however continues to involve the RET and ERF. Attempts to further integrate energy and climate change policies however have failed, one example being the *National Energy Guarantee* in 2017 by the Turnbull Liberal Government.

Energy security

Concerns of energy security have evolved during the period and also its definition, from emphasis on the security of supply and system reliability of the first COAG energy policy in 2001 to an emphasis on three main components, adequacy, reliability and affordability (or competitiveness) seen in the National Energy Security Assessments (NESA) in 2009 and 2011. Until recently, energy security concerns during the period based on the two NESAs were low but since the last assessment, the current energy sector has undergone various changes. As previously mentioned, the country faces a number of energy challenges, including energy shortages (in line with a phasing down of old coal power plants, where supply for the NEM has not yet been replaced), statewide blackouts (experienced in SA), high energy prices, the integration and appropriateness of renewable energy and the reduction of emissions.

Water

From 2000, developments in the water sector have been characterised, similar to energy policy, by national water policy making and further water reforms. Key features of water policy have in particular included the National Water Initiative (2004), the Water Act of 2007 and the Murray-Darling Basin Plan.

During the period, considerable progress was made in water reform. The range of reforms included:

- institutional reforms (commercialisation and corporatization of government entities delivering water and sewerage, separation of the roles of water resource management, standards-setting and regulatory enforcement and service provision, and the adoption of integrated natural resource management arrangements);
- pricing reforms (towards consumption-based pricing and cost recovery, reduction or elimination of cross subsidies), investment reforms (ensuring investment in new water schemes are economically viable and ecologically sustainable);

- allocation and trading reforms (implementation of comprehensive systems of water allocations or entitlements, allocations for the environment, water property rights separated from land title and entitlements clearly defined) (PC 2005, p. 26).

The states had achieved significant progress in the implementation of consumption-based pricing (PC 2005, p. 27), the separation of water access entitlements from land titles, the separation of the functions of water delivery from that of regulation and the provisions made for environmental water (COAG 2004, p. 1).

In 2004, to build upon the first COAG Water Reform Framework, the Commonwealth and states agreed to implement the *National Water Initiative* (NWI). The NWI formed the 'blueprint for water reforms' and represented the next phase of reforms. Its objectives included: secure water access entitlements; transparent, statutory-based water planning; statutory provision for environmental and other public benefit outcomes; improved environmental management practices; return of all over-allocated or overused systems to environmentally sustainable levels of extraction; removal of barriers to trade in water; clarity around risk assignment; water accounting; water use efficiency; and the integrated management of surface and groundwater. Each state and territory government was required to prepare an NWI implementation plan to achieve these goals.

The Water Act 2007 was an important feature of water governance, focusing on the sustainable management of the MDB. The Act commenced three years after the NWI and represented much of the government's plan for water security. Its purpose as stated in the legislation was 'to make provision for the management of the water resources of the Murray-Darling Basin and to make provision for other matters of national interest in relation to water and water information, and for related purposes' (*Water Act* 2007). Its key objectives captured the sharing between users and environmental and ecological considerations for water security.

The main objective for the MDB was to address the overallocation of water and to limit the volume available to users while ensuring sufficient water for the environment. The Act included a number of features: the establishment of the independent Murray-Darling Basin Authority (MDBA) to oversee water planning, representing a shift towards centralised management of the basin, allocation of water charge development and enforcement to the Australian Competition and Consumer Commission and the allocation of information provision (of Australia's water resources) to the Bureau of Meteorology. In particular, the Act provided for the development of a strategic plan (the Basin Plan which commenced in 2012) and the establishment of legally binding sustainable diversion limits. The Act further established the Commonwealth Water Holder with the responsibility of managing Commonwealth environmental water to protect

environmental assets. In 2008, the referral of state power over water in the MDB to the Commonwealth was achieved, further facilitating a national approach and also a milestone in water management in the country. Since then, intergovernmental coordination has been the principal means for water policy development and implementation.

During the period, a number of programs were implemented, including: the *National Plan for Water Security* (2007) a $10 billion investment to improve water and address the overallocation of water in rural Australia which focused, in particular, on modernising irrigation infrastructure and the *Water for the Future* (2010) program that emphasised wise water usage, securing water availability and improved environmental outcomes (climate change and river health). Other programs included the *National Action Plan for Salinity and Water* (2000) and *Living Murray Program* (2002).

While improvements have been made, assessments of reform in 2014 and 2017 however promoted further water reform and the need to maintain efforts to achieve the water objectives, urging governments to keep water on the agenda, despite the end of the millennium drought and improvements in water security. Recent experience of drought has further reinforced the need for proper long-term planning for water.

Food

Food sector developments during the period after 2000 were characterised by further liberalisation as well as national policy and regulation in food, evident in a number of key policies and the development of food standards.

After years of reform since the 1970s, Australia has had one of the lowest levels of agricultural support in OECD countries (Gray, Oss-Emer & Sheng 2014). The country is currently a net food exporter, producing food in excess of domestic demands. According to Gray, Oss-Emer and Sheng (2014), agricultural reforms have enabled greater flexibility for farmers to adjust to market conditions and have provided farmers with greater incentives to innovate and develop new products.

Current programs have continued to support producers in the management of production risks, as well as improve their productivity and efficiency, facilitate structural adjustment, adapt to climate change and improve management of natural resources (Gray, Oss-Emer & Sheng 2014). Some programs covered themes such as biosecurity, carbon farming, farm finance and drought-related programs.

In addition to continued agricultural reforms, several national policies have been implemented. In 2001, the *National Food Industry Strategy* was announced to respond to the increasing pressure of globalisation with the aim of strengthening the position of the Australian food industry as a

significant global player. The strategy involved the development of a high-level industry council and a product and service innovation strategy, supported by the Food Innovation Grants programme. Other measures included a food trade initiative to develop and implement an international food market entry strategy and a strategy to build more competitive supply as well as improving national food safety and quality systems (Franklin et al. 2006). To manage the programs, the National Food Industry Strategy Limited (private company) was established.

In 2013, the *National Food Plan* was introduced with the role of ensuring 'that Australia has a sustainable, globally competitive and resilient food supply that supports access to nutritious and affordable food' (Department of Agriculture, Forestry and Fisheries [DAFF] 2013, p. 14). Its priorities were based on four themes: 1) growing exports, 2) thriving industry, 3) sustainable food and 4) people. The last theme referred to ensuring and maintaining food security both domestically, by improving access to safe and nutritious food, particularly for those living in remote communities or struggling with disadvantage and globally, by contributing to helping farmers in developing countries gain access to new agricultural technologies and sharing expertise.

The *Agricultural Competitiveness White Paper* (2015) is the most recent document to set the direction for the agriculture sector. Its five main priorities involved improving the farm business environment, infrastructure, drought management and improving trade. Increased competitiveness and contribution to the economic growth of the agricultural sector is furthermore seen in the government's *Industry Growth Centres Initiative* for which the agricultural sector has been identified as a sector to contribute to the growth.

Australia and New Zealand have continued their cooperation in food regulation and standards since the Treaty for a Joint Food Standards Systems in 1995. In 2000, the COAG signed an Intergovernmental Food Regulation Agreement (FRA) agreeing to a new food regulatory system, providing for a cooperative national system of food regulation. The main objectives were to provide safe food controls, reduce the regulatory burden on the food sector, facilitate harmonisation of Australia's domestic and export food standards with international food standards, provide cost-effective compliance and enforcement arrangements as well as a consistent regulatory approach across all states.

The most recent food-related policy has been the *National Food Waste Strategy* (2017) released by the Department of Environment and Energy, (signalling joint responsibilities over food by departments other than agriculture-related departments). The framework involves four priorities: policy support, business improvement, market development and behaviour change. The outcomes of these priorities include policies supportive of food waste avoidance and reduction, improvement of adoption technologies, processes and actions to avoid food waste, developing

markets to support repurposing of food wastes and regarding behavioural changes, changes in practices and attitudes towards avoiding and reducing food waste (Commonwealth of Australia 2017).

At the state level, agricultural and food policies have been seen in almost all states, with the emphasis on improving the sector and enhancing economic growth. In recent times, however continued economic growth has been a challenge. There has been recent increasing attention on assistance measures to respond to the hardships of farmers affected by drought, at both Commonwealth and state levels. Drought assistance programs and farm household allowance support farmers and rural communities facing both economic and social difficulty.

Table 5.1 provides a summary of the historical developments as discussed in Sections 5.1 to 5.5.

Table 5.1: Summary of EWF developments

Period	Period 1 Early Settlement and Colonial Development (1788-1900)	Period 2 Federation, World War I and the Great Depression (1901-1938)	Period 3 Second World War and the Post-War Economy (1939-1969)	Period 4 Economic Reform, Globalisation and Environmental Awareness (1970-1999)	Period 5 Post-reform era and Contemporary Challenges (2000-Present)
General	• British colonisation • Formation of separate colonies • Colonial economic development • Subsidised immigration • Local government introduced in SA • Self-government from 1855	• Federation (1901) • Australian Constitution Act 1901 to specify powers of the Commonwealth government • Immigration Restriction Act 1901 • WW1 (1914-1918) • Protectionist Tariffs (Customs Tariff, Lynne Tariff)	• WW2 (1939-1945) • Rural Reconstruction Commission • Full employment objectives • Economic and population growth • Cold War • Vietnam War •	• Environmental Protection Act 1970 • Oil crisis (1973, 1979) • Floating of the Australian Dollar (1983) • Council of Australian Governments (COAG) 1992 • National Strategy for Ecologically Sustainable Development 1992 • Global Warming Concerns • Microeconomic reforms • National Competition Policy 1995 • Asian Financial Crisis 1997	• War on terror (2001) • Global Financial Crisis (2008) • Arab Spring • Economic growth in China • Paris Agreement • State Climate Change policies
Energy	• Development of mineral resources fostered by state governments • Introduction of electricity • Private companies, local government and state bodies responsible for electricity development • First mining and electricity legislation	• Centralisation of electricity sector commences • Commonwealth assistance to mining sector • First state electricity authority in Victoria 1919	• Australian Mining Council 1940 • Rise in electricity production • Power rationing • Centralisation of electricity sector in all states by 1952 under the responsibility of large state authorities such as State Electricity Commissions	• Australian Minerals and Energy Council 1976, National Oil Supplies Advisory Committee 1983 • Energy security concerns (oil), 1988 Energy 2000 -first national energy policy • Import price parity for oil in 1978 followed by oil deregulation in 1988	• National Energy Policy Framework 2000 • Mandatory Renewable Energy Target 2001 • Energy Market Agreement 2004 • Energy White Papers 2004, 2012, 2015 • National Energy Security Assessment 2009, 2011

Period	Period 1 Early Settlement and Colonial Development (1788-1900)	Period 2 Federation, World War I and the Great Depression (1901-1938)	Period 3 Second World War and the Post-War Economy (1939-1969)	Period 4 Economic Reform, Globalisation and Environmental Awareness (1970-1999)	Period 5 Post-reform era and Contemporary Challenges (2000-Present)
			• Extension of electricity to rural areas • Joint Coal Board between Commonwealth and NSW	• Energy sector reforms (corporatisation, commercialisation, privatisation, industry restructuring) • National Electricity Market 1995	• Energy security concerns (prices, gas supply, reliability) • Climate change policy
Water	• Drought proofing • Irrigation Act 1886 Victoria - Government control over water • Local government provision of water • First water and irrigation acts	• River Murray Waters Act 1915 to settle conflict between NSW, VIC and SA • River Murray Commission 1917 • Centralisation of water sector • State and regional authorities responsible for metropolitan water and non-metropolitan water	• Infrastructure development • Water resources development and supply of cheap water • State and regional authorities responsible for metropolitan water and non-metropolitan water • Australian Water Resources Council 1962 • Farm water subsidies	• Australian Water Resources Council 1975 • Water 2000 1982 • Commonwealth Water Policy 1984 • Water resources funding Schemes • COAG Water sector reforms 1994 (pricing, water rights, trading, water for the environment) • National Water Quality Management Policy 1994 • State government departments for water	• National Water Initiative 2004 (water sharing plans, water pricing guidelines) • Emphasis on environmental water and environmental management • National Plan for Water Security 2007 • Water Act 2007 • Murray Darling Basin Plan 2012
Food	• Agricultural activity from 1788 • Agricultural colleges and experimental farms	• Government assistance to agricultural producers, rural diversification • Australian Wheat Marketing Scheme - pooling of rural product	• War-time marketing of wheat • Emergency Supplies Plan 1940 • Commonwealth Food Control 1943 • Australian Wheat Board 1939, 1948	• Rural Reconstruction Scheme 1971 • Rural readjustment followed by stabilisation • Agricultural Reforms - reduction of financial	• National Food Industry Strategy 2001 • National Food Plan 2012 • Australian Competitiveness White Paper 2015 • Sustainable practices

Period	Period 1 Early Settlement and Colonial Development (1788-1900)	Period 2 Federation, World War I and the Great Depression (1901-1938)	Period 3 Second World War and the Post-War Economy (1939-1969)	Period 4 Economic Reform, Globalisation and Environmental Awareness (1970-1999)	Period 5 Post-reform era and Contemporary Challenges (2000-Present)
		• Sugar bounties and other trade agreements • Closer settlement, Soldier settlement schemes to settle ex-servicemen on agricultural land to improve production • Food controls for war-time planning • Australian Agriculture Council 1935	• A Rural Policy for Post-War Australia 1947 • Wheat Industry Stabilisation Plans • Agricultural assistance • Statutory marketing arrangements and authorities introduced • Wheat stabilisation plans • Price controls	assistance, tariffs and protectionist measures • Food Standards and Regulation • ANZ[1] Environment and Conservation Council, ANZ[1] Resource Management Council	• Biosecurity Act 2015 • Industry Growth Centres Initiative – Agriculture sector to drive economic growth • National Food Waste Strategy 2018
Cross-sectoral	• Introduction of irrigation in Victoria • Development of hydro-electric power in Tasmania	• Irrigation controlled by local trusts until taken over by state authorities • Hydroelectricity developments in Tasmania	• Construction of the Snowy Mountains Hydro-Electric Scheme 1949 • Soil erosion issues • Rural Electricity Subsidy Schemes (NSW) • Farm Water Supplies (NSW)	• Snowy Mountains Hydro-Electric scheme in operation • Salinity issues	• Water infrastructure development • Unconventional Gas resources development concerns over land and water resources

Source: Information drawn from Sections 5.1 to 5.5., 1. ANZ: Australian and New Zealand

5.6 Conclusions

The periods described above represented the formative stages of Australia's development from the colonial settlement, the federation of states and the country's experience through times of war, economic recovery, economic reform, up until the present. The main points are as follows:

- The first period marked the beginnings of the EWF sectors, characterised by the development of mining and agriculture, first supporting the immediate needs of the colony then becoming important export sectors and a source of economic growth and the decentralised development of water supply and electricity systems. Challenges of securing water were felt during this period and gave rise to the beginning of water control with government intervention and the introduction of irrigation to support rural expansion.
- The role of EWF sectors in the context of Australia, as seen in the first three periods, reflected a dual role for serving basic needs as well as contributing to economic growth, in which the government was highly involved. A key theme from the federation period to the post-war period was the high level of government presence and involvement in driving economic development, undertaking large-scale infrastructure projects and assisted migration schemes, and at times, intervening in markets (as seen in marketing arrangements for rural products). Protectionist policies were a key feature to ensure the continued growth of industries. The establishment of large statutory authorities and agencies to govern water and electricity across the states indicated the extent of government involvement across the states.
- The changes from the 1970s to the present, covering the last two periods, were substantial, particularly in contrast with the previous periods. The neoliberal approach to economic growth was a significant shift from the interventionist growth of the previous periods. EWF sectors underwent economic reform with the objective of improving competitiveness to better adapt to the global system and market forces. Many of the earlier reforms in the energy sector involved the corporatisation, commercialisation and in some cases privatisation of many of the government business enterprises responsible for electricity generation and gas. Later, reforms in the energy sector involved structural reforms, such as the vertical functional unbundling of the supply chain, the separation of generation, transmission, distribution and retail units and the development of the National Electricity Market. Reforms in the water sector involved the introduction of water markets, water allocation, water pricing and measures to incorporate environmental considerations in water sector development. In the agricultural sector, reforms included a gradual phase-out of protective measures and statutory marketing arrangements, signalling a reduction in government direct control and involvement in a number of rural industries.

- Despite a winding back of government involvement (of mostly direct involvement), the Commonwealth government continued to play a prominent role through national policy-making and with the establishment of the Council of Australian Governments (COAG), much of policy has been developed through intergovernmental coordination and cooperation. Both periods saw EWF issues addressed at a national level.
- The evolution of EWF sectors has been eventful and complex. Each sector has evolved according to sector-specific drivers of change (for example water scarcity in the water sector) as well as broader drivers of change (such as the economic reform and ecologically sustainable development). While differences in the characteristics of EWF have meant differences in their developments (for example, in the context of water, environmental outcomes were increasingly important more so than others), at the same time broader level interests, associated with wider economic, social and environmental agenda, influenced similar developments (for example, the need for increased competitiveness in all sectors).
- The dualist role of EWF sectors remained both to serve the basic needs of the population as well as contribute to growth. However, only during the most recent periods have constraints to such roles become more apparent. The exploitative nature of development led to consequences that have only seriously been addressed in the last few decades. For example, the need to better manage water use and to an extent, the need to reduce carbon emissions to address climate change, both to mitigate and adapt to impacts, has received greater attention in the recent times.

The historical overview provided has highlighted changes in the way EWF have been governed through formal institutions, as reflected by the changes in development philosophy (informal institutions) from one supporting high levels of government involvement to manage socio-economic matters to one supporting an 'arms-length' approach for the government. History, however neither shows a complete retraction of government nor the redundancy of government; rather, it shows the changing nature of government and its importance in the context of Australia. The government has played and continues to play an important role in EWF sectors. As basic needs, a continued role for government is still required, particularly as contemporary challenges such as energy security concerns, climate change and ongoing struggles with water variability continue to impact the country.

The following chapters provide a deeper discussion into the themes of government involvement in EWF sectors with a focus on the integration of EWF.

Chapter 6 Development Philosophies and Government Involvement

The previous chapter provided a historical overview to identify the main developments in the broader socio-economic and political contexts and EWF domains. The chapter provided the context for the following *Levels of Institutional Analysis* with the objective of examining the degree to which institutional settings have provided a framework for which EWF could be dealt with jointly, one that recognises the potential trade-offs and synergies that result from the interlinkages and interdependences between EWF and is thus able to ensure positive outcomes.

This chapter is the first of three chapters discussing the findings of the application of the *Levels of Institutional Analysis* on EWF both at Commonwealth and state levels. This chapter focusses on the first and second institutional levels associated with development philosophies and government, its characteristics and functions that shape its involvement in EWF.

This chapter is divided into three sections. Section 6.1 examines the Level 1 institutions comprising informal institutions as represented by the development philosophies that have shaped Australia's social, political and economic systems with an influence on EWF. Section 6.2 examines the Level 2 institutions associated with government, including its characteristics and functions that determine the scope of government influence in EWF. Key themes examined include intergovernmental relations between the Commonwealth and the state governments, examining financial dependency and intergovernmental coordination; level of centralisation, the mix of public and private sector involvement and the roles and responsibilities of the different levels of government. While an overview of these themes was provided in the previous chapter, this chapter places greater attention on EWF interlinkages.

Section 6.3 provides a summary and concludes.

6.1 Developmental philosophies

In the context of this research, development philosophies are a reflection of the influence of informal institutions (traditions, values, beliefs) on shaping the political, economic, social and environmental attitudes of the Australian nation. These attitudes, in turn, have shaped the evolution of the EWF sectors.

6.1.1 Political and economic

Colonial socialism, federalism and Keynesianism

From the early settlement days of the 1780s to the 1970s, development philosophies (colonial socialism, federalism, Keynesianism) reflected belief in the important role of government in the socio-economic development of the nation.

Colonial socialism (Butlin, Barnard & Pincus 1982), an outcome of self-serving and authoritarian British instincts, resulted in direct ownership of the country's resources (Wilson 2015), public control of large-scale infrastructure (e.g. railways, telecommunications, water and sewerage, urban transport and power supply) and public provision of essential services (Ergas & Pincus 2015, p. 223; Ville 2015; Wilson 2015). The government's 'commitment to aiding economic and social development' (Wilson 2015, p. 330) characterised the country's development.

Such high levels of government involvement contrasted with the mainstream ideologies of classical economics of the time which emphasised private sector involvement. According to Gilchrist (2013), the colonial socialism of the time was a pragmatic response to the needs of the young colony that required government involvement for its development, rather than any deep-rooted philosophical belief. It, however, firmly established the centrality of government in the developmental psyche of the time and its effects continued to be felt over the next several decades, for example, after the formation of the Australian Federation (1901), the government assumed a central role in nation building. Protectionism and a disinclination towards markets became the dominant development philosophy of these years.

The advent of Keynesianism in the 1930s reinforced support for government involvement in development. War-time protection and post-war economic recovery justified higher levels of government control, increasingly centralised at the federal level. With war-time powers, the Commonwealth government expanded its scope of intervention, playing a more direct role in national development and in managing the economy. The government's dedication to full employment was an indicator of Keynesianism (Welling & Fleming 2003, p. 13) along with its involvement in large-scale infrastructure projects and immigration schemes. The country's protectionist approach continued and intensified in the following years, and by the 1950s, the country had some of the highest protection levels (Lougheed 1988). These trends continued well into the early 1970s.

Neoliberalism and globalisation

In the 1970s, there was a perceptible ideological shift in the development philosophies towards neoliberalism. As Fenna (2013) described, this represented a 'fundamental shift away from a

statist and protectionist approach to economic policy in Australia' (p. 99). Interrelated factors including the decline in economic performance and living standards, particularly in comparison with other OECD countries and a number of economic problems, such as stagflation and low productivity, provided the impetus for this change. It is also important to note that these changes were aligned with global trends that saw a number of countries also pursue neoliberal economic reforms. Further, neoliberal principles received bipartisan support from both Labor and Liberal governments. Consequently, a series of economic reforms were implemented across the country, from macroeconomic measures (e.g. reduction in tariffs, phase-down of protection, floating of the dollar) to microeconomic reforms in a number of sectors, in particular, energy (electricity and gas) and water. Deregulation, privatisation, competition and productivity were the main means to improve Australia's otherwise stagnating economy. In 1995, the National Competition Policy (NCP) was implemented, led by the Commonwealth government, to coordinate reforms under a national approach. Economic reforms reflected a significant change in the development philosophy and ideology during this period.

6.1.2 Social

White Australia Policy to multiculturalism

During the colonial period and the early years of federation, the majority of the population was of British or Irish descent. British customs and laws influenced the development of Australia's legal system and its culture. The social policies of the time, therefore, promoted British interests. After federation, part of the development philosophy was associated with the desire to maintain a predominantly British population. By the 1970s, government objectives to increase the population to stimulate growth led to new immigration policies that enabled immigration from non-European countries. This resulted in the multicultural society that Australia has today.

6.1.3 Environmental

The emergence of water issues over the period from the late 1870s to the 1970s provided the backdrop for the environmental policies of the time, for example, drought-induced scarcity and the need to secure irrigation to promote agriculture in the 1880s, soil erosion and rising salinity impacting both water resources and the agriculture sector in the 1940s. These issues gave rise to efforts to coordinate land and water resources across the states.

Environmentalism

The 1970s marked heightened levels of environmental consciousness at a global level, promoted by concerns about global warming, climate change, and other human-induced environmental

damage, e.g., salinity, soil erosion, loss of biodiversity, pollution and water resource scarcity. The Brundtland Report (1988), with an emphasis on issues of intergenerational equity and sustainable development, resulted in the embedment of the notion of *sustainable development* into the development philosophies of the times.

The first Environmental Protection Act was enacted in 1974 followed by the Environmental Protection and Biodiversity Act in 1999. The National Strategy for Ecological Development (1992) provided principles for environmental management alongside economic and social development. Specific organisations were established to oversee the development and implementation of environmental policies, e.g., the Environmental Council in 1972, Australian and New Zealand Environment and Conservation Council in 1991, the Standing Council on Environment and Water 2001, and a plethora of government departments.

The deepened engagement of government in environmental areas reflected a shift in development philosophy, with an increased emphasis on incorporating environmental sustainability into policymaking.

6.1.4 Main points

The main points of the analysis are:

- The development philosophies from the early settlement to the 1970s included the acceptance of the role of government in economic development. From the 1970s, a transformation took place in the development philosophies away from Keynesianism, towards neo-liberalism. One of the outcomes of such shifts from Keynesian to neo-liberalism was the change in the role of government in social and economic development, including the EWF sectors (discussed further in the next section). This reflected the influence of informal institutions on formal institutions.
- Other changes to development philosophies during the period included a growing acceptance of a multicultural Australia, a result of economic interests for population growth overriding the need to protect and maintain a predominantly British society, and rising environmental awareness, thus elevating the importance of environmental considerations in economic planning.
- In summary, it is evident that the evolution of development philosophy in Australia has been influenced by internal factors (including national objectives and domestic conditions) and external factors (including global movements and ideological shifts). The changes in development philosophies have had implications on the priorities and interests of the government and the way in which it frames its response to the economic, social and environmental challenges it confronts.

6.2 Government (Characteristics and functions)

This section discusses Level 2 institutions represented by the government, particularly, its characteristics and functions. This involves examining intergovernmental relations and government involvement and how these affected the evolution of EWF sectors. Government involvement looks at the level of centralisation in EWF sectors, for example, how powers and responsibilities are distributed along the various tiers of governments, the role of the private sector and public-private influences on shaping the roles and responsibilities of government over EWF sectors.

6.2.1 Intergovernmental relations

Financial dependency

Since early settlement, colonial governments and state governments have depended on higher-level government funding, from dependency on British funding to dependency on Commonwealth funding. Financial relations in Australia has typically been characterised by a vertical fiscal imbalance, a feature of the Australian federation, which describes the situation of excess revenues of Commonwealth governments and insufficient revenues of state governments, where excess revenue of the Commonwealth is used to fund state spending. As a result, the Commonwealth has been able to influence the states through their funding dependency.

The financial relations between the Commonwealth and state governments and the beginnings of a vertical fiscal imbalance were established in the constitution. At federation, the Commonwealth government became responsible for the collection of custom duties which were previously the main source of state revenue. However, under section 87 of the constitution known as the Braddon Clause, the Commonwealth was obliged to return three-quarters of these funds to the states (ABS 1908).

Under the Revenue Surplus Act 1908 (amended in 1910), the surplus payments system was abolished and replaced with a system of equal per capita payments from the Commonwealth to the states (Burton, Dollery & Wallis 2002). Special assistance grants (equalisation grants) were paid to the financially weaker states, including Western Australia from 1910 to 1911, Tasmania from 1912 to 1913 and South Australia in 1929 to 1930 (Mathews 1988, p. 861).

Under a financial agreement between the Commonwealth and states in 1927, the equal per capita grants system was replaced with a system of annual payments to the states as a contribution towards interest on state debt. The Australian Loan Council was established for the purpose of coordinating Commonwealth and state borrowing.

In 1933, the Commonwealth Grants Commission was established to investigate applications by states for special financial assistance, and in 1936, it put forward a new principle for determining special grants based on financial needs. This was to replace the old principle of grants to compensate states for the impacts of federation and Commonwealth policies (Mathews 1988). Grants then became fiscal capacity equalisation grants (Mathews 1988). These were to ensure that poorer states could receive sufficient funding for the provision of services comparable to those provided in richer states. Through its control of funding, the Commonwealth sought to ensure a minimal gap between the welfare across the states.

During World War II, state governments became increasingly dependent on the Commonwealth Government who under the Uniform Tax agreement in 1942, obtained from the states control over income and company taxation. Through a system of grants, including tax reimbursement and other state financial grants, the Commonwealth redistributed these funds. State grants took the form of either general purpose grants or specific purpose grants (Mathews 1988).

Nevertheless, the states became increasingly financially dependent on the Commonwealth Government. According to Mathews and Jay's 1972 study (cited in Burton, Dollery & Wallis 2002, p. 35), in the fiscal year from 1948-49, the Commonwealth collected 88% of all taxes levied in Australia, compared to 8% per cent by the states and 4% by local governments. The authors. Mathews and Jay describe the Commonwealth Government as having 'fiscal supremacy' (cited in Burton, Dollery & Wallis 2002, p. 35).

Special purpose grants, however, were the means by which the Commonwealth could influence states, and this was especially relevant in the context of water sector development. Through special grants, the Commonwealth was responsible for providing financial assistance to states for the purpose of improving water resource management, and this was seen in the States Grants (Water Resources) Act 1964. These grants had an important role in ensuring equitable water resource management across the country. Financial assistance in water continued into the following years, influencing the way in which the states managed their water resources.

From the 1970s, the Commonwealth Government continued to provide finance to the states through general purpose grants and specific purpose grants. According to Burton, Dollery and Wallis (2002), early in the period, there was a growing reliance on specific purpose grants to the states. Total transfers to the states from the Commonwealth Government grew from 8.1% of national product in 1972-73 to 11.2% in 1975-76, with special-purpose capital grants expanding from 2.1% to 5.4% (Burton, Dollery & Wallis 2002, p. 36 cite Mathews and Grewal, 1997, p 88). In the 1980s, under the Hawke-Keating government, payments to the states decreased, arrangement payments fell and specific purpose grants were substituted for general revenue funds. Another set of payments to the states included the tranche payments, paid to incentivise states to

undertake reform under the National Competition Policy. As mentioned, such financial incentives attributed to the success of the reforms (Banks 2005; PC 2005).

According to the National Commission of Audit (2014, p. 145), the vertical fiscal imbalance between 1970 to the end of 1999 ranged from 60% in 1979-1980 to just below 40% in 1999-2000. In 1999, the Howard Liberal government implemented reforms on financial relations with the objective of simplifying taxes in the country, reforming a number of taxes and removing taxes that were deemed inefficient, hindering economic activity. It also sought to reduce the dependency of state and territory governments on the Commonwealth. Under the agreement, special purpose grants were to remain but Financial Assistance Grants were to cease. In 2000, the government introduced the Goods and Services Tax. The revenues of the tax were to be distributed entirely to the states. Financial dependency of the states on the Commonwealth reduced.

Further reforms to financial relations were seen to foster greater coordination between Commonwealth and state governments. This was evident in 2006 when the Intergovernmental Agreement on Financial Relations was signed. The agreement recognised the importance of states in the delivery of goods and services.

In the context of water, the Commonwealth Government continued to provide financial assistance to the states to support water resource development. In 1978, the Commonwealth established the National Water Resources Program, providing funds under the National Water Resources (Financial Assistance) Act 1978 through grants and loans for programs of national significance. Projects included those related to urban and rural water supplies and rescue, flood mitigation, land drainage and floodplain management, addressing long-term use of existing water resources, water quality management, salinity control, water resources assessment and control, regional planning and management investigations. Further financial assistance for the development of water resources continued into the period via the Federal Water Resources Assistance Program during the mid-1980s. Financial programs for states have been important to ensure equalised development of water across the country. Financial assistance was also provided by the Commonwealth to support states to implement rural reconstruction and adjustment schemes.

Intergovernmental coordination

The introduction of the federal government enabled coordination between states but has also required intergovernmental coordination between the levels of government.

After the formation of the federation, instances of intergovernmental coordination were seen in all EWF areas. In the context of water, intergovernmental coordination has been important in managing the water use between the states that share the River Murray, namely, NSW, Victoria

and SA. In drafting the constitution, water use was a key area. In 1915, the River Murray Agreement was one instance of coordination between states. The Australian Agricultural Council established in 1934 was the first Commonwealth-state ministerial council, established to coordinate common agricultural policies. The Australian Mining Council, established in 1940, also brought together states and Commonwealth ministers. The Snowy Mountains Hydro-Scheme which commenced in 1949, required cooperation between the Snowy Mountains states. The Australian Water Council, established in 1962, similarly brought together Commonwealth and state ministers responsible for water resources. Another example of intergovernmental cooperation included the National Water Resources and Development Programme 1966, introduced as an initiative by the Commonwealth Government to support the development of water projects aimed at reducing the hazards of droughts and expanding primary production through the provision of grants to the states. The only instance of inter-sectoral and intergovernmental coordination was during the late 1940s, as seen in the Snowy Mountains Hydro Scheme.

Intergovernmental coordination from the 1970s to the present has become an important feature of policymaking. Prior to the 1990s, one platform for which Federal and state leaders convened for intergovernmental policy was the Special Premier Conferences. Intergovernmental relations during this period were greatly influenced by the national economic reform agenda which was one of the main drivers for increased intergovernmental coordination. In 1992, in an attempt to foster greater cooperation between the states with a view to further the national reforms, the Council of Australian Governments (COAG) was formed, evolving from the Special Premiers Conferences. The COAG continues to be an important feature of Australian intergovernmental cooperation and policymaking. The main role of the council is to 'manage matters of national significance or matters that need co-ordinated action by all Australian governments' (COAG 2018).

From the 1970s to the present, there has been increasing intergovernmental coordination in EWF areas. This was particularly evident during the period of microeconomic reforms - in the energy sector with the development of the National Electricity Market and in water management particularly regarding the Murray-Darling Basin - with the establishment of the Murray-Darling Basin Commission replacing the previous River Murray Commission in 1988.

In the last several decades, intergovernmental coordination has become increasingly important in the implementation of policy, particularly in EWF sectors. Policy coordination has been achieved through a number of intergovernmental agreements in the areas of EWF and the environment. The establishment of ministerial councils, comprising of Commonwealth and state

representatives, to deal with specific issues, have played a significant role in facilitating cooperation for the purposes of developing policy that is consistent across states.

Some of the key Intergovernmental Councils and Agreements are listed in Tables 6.1 and 6.2, respectively.

Table 6.1: Intergovernmental Councils

Intergovernmental Council	Year established	Energy	Water	Food	Other
Australian Agriculture Council	1934			✓	
National Health and Medical Research Council	1936		✓	✓	
Australian Mining Council	1940	✓			
Snowy Mountains Council	1949	✓	✓	✓	
Australians Water Resources Council	1962		✓		
Australian Environmental Council	1972		✓	✓	
Australian Minerals and Energy Council	1976	✓			
Murray-Darling Basin Ministerial Council	1985		✓	✓	
National Food Standards Council	1986			✓	
Australian Coal Marketing and Technology Council	1988	✓			
Council of Australian Governments	1990				✓
Australia New Zealand Food Standards Council	1991			✓	
National Grid Management Council	1991	✓			
Australia New Zealand Food Standards Council	1991			✓	
Australian and New Zealand Environment and Conservation Council	1991	✓	✓		
Agricultural and Resource Management Council of Australia and New Zealand	1994		✓	✓	
Ministerial Council on Energy	2000	✓			
Australia New Zealand Food Regulation Ministerial Council	2000			✓	
Environment Protection and Heritage Council	2001		✓		
Natural Resource Management Ministerial Council	2001	✓			
Standing Council of Energy and Resources	2011	✓			
Standing Council on Environment and Water	2011		✓		

Intergovernmental Council	Year established	Energy	Water	Food	Other
COAG Energy Council	2013	✓			
Meeting of Environmental Ministers	2013		✓		✓

Table 6.2: Intergovernmental Agreements

Intergovernmental Agreements	Year	Energy	Water	Food	Other
River Murray Agreement	1914		✓	✓	
Murray Darling Basin Agreement	1987		✓	✓	
Intergovernmental Agreement on the Environment	1992				✓
Agreement on National Electricity Code	1996	✓			
National Electricity Market Agreement Legislation	1996	✓			
National Gas Pipelines Access Agreement	1997	✓			
Intergovernmental Agreement Food Regulation Agreement	2000			✓	
Intergovernmental Agreement on a National Water Initiative	2004		✓		
Australian Energy Market Agreement	2004	✓			
Food Regulation Agreement - Annex A - Annex B	2008			✓	
Murray-Darling Basin Intergovernmental Agreement - Attachment A - Murray-Darling Basin Reform - Memorandum of Understanding	2008		✓		
Intergovernmental Agreement on Energy Supply Industry Safety	2012	✓			
Intergovernmental Agreement on Biosecurity	2012			✓	
Intergovernmental Agreement on Implementing Water Reform in the Murray Darling Basin	2017		✓		

Integration of EWF

With shared responsibilities for EWF, policies are implemented through cooperation between the Commonwealth and the states. The role of the Commonwealth in EWF has increased in recent years. Through national policies, the Commonwealth has played a greater role in setting the direction and priorities for EWF sectors. Coordination of the states has been necessary in order to meet increasingly national objectives and to avoid inter-state conflicts. The Commonwealth government sets the national policy priorities while the states implement them, according to what is most suitable for their jurisdictions, considering local issues and opportunities. The National

Competition Policy reforms exemplified this, showing how states implemented reforms based on a Commonwealth agenda supported primarily by an incentive scheme through tranche payments from the Commonwealth to the states to ensure state progress. Financial incentives also existed to encourage implementation of the National Water Initiative. COAG (established in 1992) has become an important platform for intergovernmental issues as well as other special intergovernmental councils that have been important to support policy making and implementation.

As seen in Table 6.1, very few councils, however, have incorporated the policy issues of all three EWF sectors. Councils that have dealt simultaneously with inter-sectoral issues of either energy, water or food include the National Health and Medical Research Council with scope across both safe water and food, the Snowy Mountains Council with scope across EWF matters, the Agriculture and Resource Management Council of Australia and New Zealand and the Murray Darling Basin Ministerial Council, both with scope across water and food matters. No specific council has, however been formed with the purpose of dealing simultaneously with the nation's overall EWF policies.

Currently, no similar councils dealing with all three EWF matters exist and separate councils represent separate sectors reinforcing the separation between EWF governance. For example, the COAG energy council comprises relevant energy ministers but does not bring together relevant water or food-related ministers. Hence, no council brings together representatives of all three sectors of EWF into one forum.[10]

Importance of intergovernmental coordination

Intergovernmental coordination and cooperation is necessary to support EWF nexus-based governance for several reasons. Firstly, EWF matters are not contained within the jurisdictional boundaries of states. This is apparent in the case of water, in the context of the Murray-Darling Basin which is a transboundary resource and in energy (electricity) with the National Electricity Market, where electricity issues in one state may result in issues in other states. This means that efforts influence EWF in one state could impact the EWF situation in another state. One example has been the negative impact of the weak enforcement of water regulations and rights in upstream states on downstream states. Each state has competing uses for energy, water, land and other resources which makes cooperation and coordination increasingly necessary. Growth (both in the economy and population) may exacerbate these pressures.

[10] Only if the ministers have multiple responsibilities (e.g. Minister for Energy and Water) will they be able represent the interests of multiple sectors.

Intergovernmental coordination is important as it can improve policy making and the likelihood of implementing policy at the state level. Rather than the government dictating rigid policies to states, increased cooperation and collaboration between levels of government is likely to lead to better policy outcomes. State autonomy in policy implementation enables state governments to adjust to local conditions in a way that is best suited to the constituents of its jurisdictions.

While increasing cooperation is positive, the only downfall is the extent to which these councils and forums are utilised for the purposes of integrated EWF policy. Despite progress in areas of EWF, cooperation is still based on a siloed approach to EWF.

6.2.2 Government involvement in EWF sectors

This section analyses government involvement in EWF sectors looking at the level of centralisation, the mix of public and private sector involvement and the government's role and responsibilities to develop an understanding of the government's scope (across all tiers of government) to influence EWF sectors. Whereas Chapter 5 described the overall level of government involvement over time, this chapter discusses government involvement specifically in the context of EWF sectors with an emphasis on similarities and variation between the Australian states.

Early development to the 1970s

From early developments to the 1970s, government involvement has varied across EWF sectors, characterised by shared responsibilities between the three levels of government (federal, state and local), and varying according to the needs of each sector in each state. Over the first three periods, centralisation, consistent with the rising level of government involvement, was a common theme in all states.

Prior to federation, government responsibilities in energy (mining, electricity), water (water supply, sewerage and irrigation) and food (agricultural and pastoral activity) were shared between state and local governments. The agricultural sector and mining sector were developed at the colonial then state level. State governments played a largely regulatory role in agricultural, pastoral and mining activity, determined by state land-use policy and legislation. State governments typically provided financial and technical assistance to primary sectors and developed agricultural colleges and experimental farms. At the local level, local governments, under a number of municipal and local legislations, were made responsible for water supply and sewerage, electricity, construction and maintenance of works, provision of services and regulation through local by-laws. While state governments were prominent in primary sectors, they played little role in the decentralised and local, water and electricity supply sectors.

The establishment of the federal government in 1901 led to the greater centralisation of government intervention. However, its role in EWF sectors was largely limited by the Australian Constitution which did not specify EWF matters as part of federal powers. This meant that such powers remained with the states, as residual powers. Despite this, through its power over trade and external affairs (trade controls, protectionist assistance), the federal government had an indirect role, particularly in agriculture and mining.

Government intervention at the beginning of federation was characterised firstly, by state involvement in primary sectors (agriculture, mining) and then gradually federal involvement; secondly, by state and local involvement in water supply and electricity in addition to private involvement with no federal government involvement; and thirdly, by little involvement of government (across all levels) in other energy-related areas such as gas and oil, which were mainly private concerns. Electricity and water sectors throughout the first three periods became largely centralised under the authority of large state organisations or state government departments.

Transition to a market economy from the 1970s to present

The years from the 1970s to the present were characterised by the changing role of the government from a direct interventionist role in the economy to an arms-length role. The changes in government involvement were in line with the economic reforms implemented during the period that sought to improve the country's economic performance through deregulation, privatisation and competition. These changes in the role of the government reflected wider development philosophy shifts that promoted the transition of the economy towards a market-based neoliberal economy and a reduction in the role of the government and greater involvement by the private sector.

Another feature of the role of the government during these periods was the centralisation of policy at the federal level, particularly in EWF sectors, historically policy matter of the states. While the government became less involved in the direct control and operations of industries, its role was strengthened in areas of broader-level policy making, coordination and regulation to guide and regulate the industries that were now subject to market forces and engaging in profit-maximising behaviour. To support the economy's transition, a number of new organisations were established, including intergovernmental bodies, agencies, councils and forums as well as non-government independent organisations, including independent regulators (e.g. Australian Competition and Consumer Commission) assigned to enforce the new rules to govern markets.

Government involvement during the period was in contrast to that of the previous periods. A new role for the government emerged as its old role evolved into one that was to oversee economic

development, rather than be directly involved in the operations of industries and the provision of goods and services. The new role of the government was to ensure a suitable environment for growth that would support the rise in private activity and competition. Privatisation and deregulation was an important feature of reforms. Government allocation of services (a feature of the previous period) was substituted with market forces and competition. The mix of public and private involvement varied across the states. For example, while the electricity and gas sector in the country achieved partial privatisation in some states (NSW, Victoria, SA), other states (Queensland, Tasmania and NT) maintained government control of their electricity and gas sector corporations. While the water sector was corporatised, this sector in all states remained in the hands of the government, although some irrigation infrastructure providers were private.

Currently, the private sector continues to play an important role in EWF sectors supported by governments, underpinned by neoliberal development philosophies.

Overview of government involvement

Mining

Both Commonwealth and state governments played a role in the mining sector. Mineral rights were vested in the Crown, held by state governments with respect to mineral resources within their boundaries. In the Territories, these rights were vested in the Commonwealth (ABS 1965). The government played a role in the control of mining, exploration, petroleum exploration and exports (Commonwealth responsibility) and the collection of mineral royalties. Both Commonwealth and state levels could legislate to regulate the mining industry through mining rights, licenses and permits. Both governments provided financial and technical assistance along with a number of specific mining industry services at the state level, including undertaking investigations for mineral exploration. A number of national-level and interstate-based organisations established during the period reflected greater coordination, centralisation and involvement by the Commonwealth Government. One example includes the Joint Coal Board between NSW and the Commonwealth, established in 1947. Commonwealth Government involvement was in international trade, customs and excise, tax and loans, financial assistance, the promotion of petroleum exploration and from the late 1970s to the late 1980s, oil pricing.

Electricity

The early years of electricity development, introduced in the late 1800s, was characterised by a number of organisations responsible for generation and distribution. This involved a combination of private companies and local councils, both responsible for the construction of electricity works and the supply of electricity to the populations of each state. Responsibility for electricity supply, in terms of construction and maintenance, generation and distribution were specified in local and

municipal acts and state acts. Local governments, in particular, were mainly responsible for the provision of public lighting, one of the first uses of electricity.

Electricity supply was a matter for the separate states and was primarily a local issue until electricity transmission across longer distances was possible (ABS 1953). The degree of centralisation and the allocation of responsibilities over electricity varied across the state during the period. In many states (NSW, Victoria, Queensland and SA), statutory authorities were established with the objective of coordinating and unifying electricity supply within their state. In Tasmania and early in WA, government bodies were responsible for electricity supply. The years after World War II were characterised by an acceleration of the nationalisation and centralisation of the electricity supply (ABS 1953).

Over the 1980s and 1990s, the model of large state authorities comprising the energy sector became increasingly replaced with a model of corporatisation, in some cases privatisation, the segregation of these authorities into different functions, and the emphasis of a transboundary, interstate energy market, underpinned by the need for greater competition to improve productivity and efficiency in the sector. Electricity reforms contributed to a reduction of government involvement in the sector.

In the early years of electricity development, the Commonwealth government played almost no role in the electricity and gas sectors as they were primarily state and local government concerns. In the late 1940s, the Commonwealth government's involvement was seen in the Snowy Mountains Hydro Scheme. From the 1970s, the role of the Commonwealth government in the energy sector became more prominent, and this was seen in a number of areas (oil pricing, national energy policy, National Competition Policy and the National Electricity Market). A number of organisations and agencies at the federal and intergovernmental levels had important roles in the development of the energy sector, such as providing policy advice, policy implementation and regulation. While the states remained constitutionally responsible for energy in their jurisdictions, there was greater involvement of the Commonwealth Government in areas of energy than previously experienced. This involvement reflected the greater centralisation of the energy policy and goal development at the national level.

Water

In each state, water sectors developed with a mix of private and public sector involvement at local levels. Water systems were developed to serve local purposes in jurisdictions under the responsibility of water trusts. The centralisation of the water sector took place towards the end of the 1800s. Centralisation involved the establishment of metropolitan-based water boards which assumed the main responsibilities of governing water supplies in metropolitan areas and later, the establishment of large statutory bodies including a number of State Water Commissions, made

responsible for irrigation and water supplies in non-metropolitan areas. Although state governments eventually had greater control through these government-appointed boards, responsibilities were shared with local governments, who with the financial assistance of state government were also empowered to construct waterworks, where needed. State governments could make laws while local governments made by-laws concerning local water matters including charging water rates. The primary authority over water rested with the states, responsible for their respective jurisdictions through statutory agencies and government departments. The centralisation of water at the Commonwealth level, however, was evident through the government's involvement in the River Murray, the Snowy Mountains Hydro Scheme, particularly with the establishment of the Australian Water Resources Council in 1962, and the provision of water grants to the state from the mid-1960s.

The changes in government involvement were sparked by emerging water issues over the 1970s and 1980s which eventually led to reforms in water that became part of the country's overall economic reform. The Commonwealth Government's involvement was associated with its role in promoting the sustainable management of water with greater cooperation between states, rather than the continued exploitation of water resources. Similar to the electricity sector, water reforms involved the corporatisation of utilities, industry restructuring as well as the separation of roles from service provision, standard setting and regulation (PC 2005), which had been the combined responsibility of statutory authorities. However, unlike the electricity sector, utilities remained government-owned corporations. Privatisation occurred in areas of irrigation with the establishment of independent irrigation infrastructure operators.

Food

Government involvement in the food (agriculture) sector was characterised by financial assistance and the development of agricultural colleges and experimental farms, particularly in the early periods. Similar to mining, the food sector was centralised at the state level, and unlike the energy and water sectors, the Commonwealth Government had been highly involved, particularly through its powers over trade, external affairs, customs and taxes. These powers enabled the Commonwealth to have greater scope for involvement in the agricultural sector than was possible in energy (electricity) and water sectors. Trade policy in the first decade was one way in which the Commonwealth could influence rural production, and this was important given agricultural products were a large source of exports for the country. Governments at both levels sought to enhance rural industry and promote rural expansion.

In the decades after federation, government support for the sector rose through protectionist measures with the introduction of tariffs and rural assistance, which over the period became more

centralised, provided by the Commonwealth as well as by states. At the Commonwealth level, incentives for production were provided through bounties and protection was provided through export controls legislation (e.g. dairy produce, dried and canned fruit, as well as other specific product-based industries) and trade agreements (e.g. sugar agreements and sugar purchasing). Between 1901 to the late 1930s, in addition to the broad tariffs introduced, governments implemented a number of measures, including fertiliser regulations and other specific industry-based acts.

At the state level, agricultural land was shaped by land policy, including soldier settlement schemes to resettle ex-servicemen on new farms and legislation through land rights and licenses. Agricultural banks were established to provide finance to enhance entry to rural industries, to assist farmers and administer rural loans. The provision of farming relief was also important. In order to encourage rural diversification, state governments intervened to provide important infrastructure, such as branch railways and irrigation and subsidised services (Butlin, Barnard & Pincus 1982).

From World War I to the 1970s, a key feature of government involvement in the agricultural sector was the establishment of statutory marketing arrangements administered by statutory marketing authorities (SMAs) to assist sectors in volatile export markets (particularly in the wheat industry). Statutory marketing arrangements were an example of government policy that reflected greater direct government involvement in the rural industries through organised marketing schemes. An example of these schemes included the wheat marketing schemes, implemented in coordination by the Commonwealth and the state of NSW, Victoria, SA, and WA. These schemes were to support wheat harvests, coordinate stock, disposal, sale, distribution and transport, and control pricing. In 1934, the Australian Wheat Board was established as the sole authority for wheat marketing. Assistance to wheat was an important aspect of Commonwealth government assistance and protection.

Marketing arrangements in rural industries became more prominent during and after World War II. With unfavourable conditions for many food-related rural industries, the Commonwealth government played an increasingly direct role in supporting the sector but assuming an active role in the control of production, marketing and consumption and stabilisation for the protection of farmers' incomes. Various regulations under the national security regulations were implemented for a number of rural food products. Marketing schemes involved price stabilisation, guaranteed prices and home consumption prices, acquisition of products, control of purchases, sales and disposal. Other protectionist measures included bounties, subsidies, trade controls (export controls bilateral agreements, guarantees and purchasing agreements), financial assistance and research support. Special statutory boards (marketing authorities) were established for different

rural products to operate these marketing schemes. Prior to the 1970s, the sector was subject to high levels of regulation.

In the 1970s, the role of the government in the agricultural sector changed significantly, contrasting from its involvement in the sector in the previous periods. The role of the government changed from one that was directly involved in the sector, through its monopoly approach to assist rural producers and protect industries from volatile market environments with protectionist measures such as tariffs, pricing schemes and marketing arrangements, to one that facilitated a transition towards agricultural liberalisation.

Reforms led to a reduction in government support, protectionist measures and an overhaul of statutory marketing arrangements (an important channel through which the government controlled many aspects of the sector), all seeking to introduce competition and expose the industry to greater global market forces. Reforms were brought about by a number of factors, including the recognition of inefficiencies in agricultural protection and the increased scrutiny of agricultural policies as well as increased international pressure as a result of trade negotiations under the GATT.

State government departments maintained their responsibility for state agricultural policy, and although continuing to assist the industry, assistance was to facilitate innovation, productivity and adjustment rather than protect and shelter industries from unfavourable market conditions. Fertiliser subsidies, however, continued until the late 1980s (IC 1998). Extension services continued to be provided by state governments, however they were also offered by private firms (Gray, Oss-Emer & Sheng 2014). The direct involvement of the government in agriculture declined as protection declined and as the sector was liberalised.

The current role of governments in the agricultural sector is to support its growth and competitiveness without the direct involvement of previous periods. Drought relief, however, remains a form of government assistance.

Commonwealth and states

The importance of understanding government involvement is because government involvement can influence the separation or integration of EWF, according to its overall influence in each sector. Over the periods, government involvement in EWF has varied across the jurisdictions and the governments' responsibilities and scope to influence EWF sectors has varied across sectors. Together, these have reinforced the separation of EWF. This section discusses the extent to which

the integration of EWF has been possible.[11] Table 6.3 summarises how government involvement and responsibilities have evolved across the five periods and amongst the states. The table shows the type of authority and the level of government (Commonwealth, state or local) responsible for policy, regulation and provision in each sector for each period and in each state. It indicates the trend of centralisation in electricity, water and gas and also the increasing role played by the Commonwealth.

[11] Further details regarding government involvement in EWF for each jurisdiction is provided in Appendix C.

Table 6.3: Government Involvement in EWF sectors

			PERIOD 1			PERIOD 2			PERIOD 3			PERIOD 4			PERIOD 5			CURRENT		
STATE			POL	REG	PROV	POL	REG	PROV	POL	REG	PROV	POL	REG	PROV	POL	REG	PROV	POL	REG	PROV
COM	E	Elect /Gas	-	-	-	x	x	x		x	x	G	x	SA	G	IR	GC	G	IR	GC
		Mining	-	-	-	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x
	W	Sup/Sew	-	-	-	x	x	x	x	x	x	G	x	SA	G	IR	x	G	IR	x
		Rural	-	-	-	G	G	x	G	G	x	G	G	SA	G	IR	x	G	IR	x
	F		-	-	-	G	G	SA	G	G	SA	G	G	x	G	IR	x	G	IR	x
NSW	E	Elect /Gas	x	LC	LC Pr	x	G LC	LC Pr	x	G	SA	G	G	GC	G	IR	Pr	G	IR	Pr
		Min	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x
	W	Sup/Sew	x	LC	SA	x	LC	SA	G	LC	SA	G	G	SA	G	IR	GC	G	IR	GC
		Rural	G	O	O	G	G	SA	G	SA	SA	G	G	SA	G	IR	Pr	G	IR	Pr
	F		G	G LC	x	G	G LC	SA	G	G LC	SA	G	G	Pr	G	G	Pr	G	G	Pr
VIC	E	Elect /Gas	x	LC	LC Pr	x	SA	SA	x	G	SA	G	G	Pr	G	IR	Pr	G	IR	Pr
		Min	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x
	W	Sup/Sew	x	LC	LC	x	SA	SA	x	SA	SA	G	G	G	G	IR	GC	G	IR	GC
		Rural	G	LC	LC	G	SA	SA	G	SA	SA	G	G	G	G	IR	GC	G	IR	GC
	F		G	G LC	x	G	G LC	SA	G	G LC	SA	G	G	Pr	G	G	Pr	G	G	Pr
QLD	E	Elect /Gas	x	LC	LC Pr	x	SA	SA	x	SA	SA	G	SA	SA	G	IR	GC	G	IR	GC Pr
		Min	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x
	W	Sup/Sew	x	LC	LC	x	LC	LC	x	SA	SA	G	SA	SA	G	IR	GC	G	IR	GC LC
		Rural	x	G	x	x	SA	SA	x	SA	SA	G	SA	SA	G	IR	GC	G	IR	GC
	F		G	G LC	x	G	G LC	SA	G	G LC	SA	G	G	Pr	G	G	Pr	G	G	Pr
SA	E	Elect /Gas	x	LC	Pr	x	x	Pr	x	O	O	G	O	O	G	IR	Pr	G	IR	Pr
		Min	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x
	W	Sup/Sew	G	G	G	G	G	G	G	G	G	G	G	G	G	IR	GC	G	IR	GC
		Rural	G	G	G	G	G	G	G	G	G	G	G	G	G	IR	Pr	G	IR	Pr
	F		G	G LC	x	G	G LC	SA	G	G LC	SA	G	G	Pr	G	G	Pr	G	G	Pr
TAS	E	Elect /Gas	x	LC	LC	x	G	G	x	SA	SA	G	SA	SA	G	IR	GC	G	IR	GC
		Min	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x
	W	Sup/Sew	x	LC	LC	x	LC	LC	x	SA	SA LC	G	SA	SA LC	G	IR	GC	G	IR	GC
		Rural	x	LC	LC	x	G LC	G LC	x	SA	SA	G	SA	SA	G	IR	GC	G	IR	GC
	F		G	G LC	x	G	G LC	SA	G	G LC	SA	G	G	Pr	G	G	Pr	G	G	Pr
WA	E	Elect /Gas	x	LC	LC Pr	x	G	G	x	SA	SA	G	SA	SA	G	IR	GC	G	IR	GC Pr
		Min	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x	G	G	x
	W	Sup/Sew	x	x	G Pr	G	G	G	G	G	G	G	SA	SA	G	IR	GC	G	IR	GC
		Rural	x	x	G Pr	G	G	G	G	G	G	G	SA	SA	G	IR	GC	G	IR	GC
	F		G	G LC	x	G	G LC	SA	G	G LC	SA	G	G	Pr	G	G	Pr	G	G	Pr
NT	E	Elect /Gas	-	-	-	-	-	-	-	-	-	G	SA	SA	G	IR	GC	G	IR	GC
		Min	-	-	-	-	-	-	-	-	-	G	G	x	G	G	x	G	G	x
	W	Sup/Sew	-	-	-	-	-	-	-	-	-	G	SA	SA	G	IR	GC	G	IR	GC
		Rural	-	-	-	-	-	-	-	-	-	G	SA	SA	G	IR	GC	G	IR	GC
	F		-	-	-	-	-	-	-	-	-	G	G	Pr	G	G	Pr	G	G	Pr
ACT	E	Elect /Gas	-	-	-	-	-	-	-	-	-	G	SA	SA	G	IR	GC	G	IR	Pr
		Min	-	-	-	-	-	-	-	-	-	G	G	x	G	G	x	G	G	x
	W	Sup/Sew	-	-	-	-	-	-	-	-	-	G	SA	SA	G	IR	GC	G	IR	Pr
		Rural	-	-	-	-	-	-	-	-	-	G	x	x	G	IR	x	G	x	x
	F		-	-	-	-	-	-	-	-	-	G	G	Pr	G	G	Pr	G	G	Pr

Source: Author's compilation from analysis derived from data sources listed in Appendix D

Note: **Responsibilities** - POL: Policy, REG: Regulation, PROV: Service provision; **Sector** – Elec/Gas: Electricity and Gas, Min: Mining, Sup/Sew: Water Supply and Sewerage, Rural: Rural water; **Authority –** G: Government Department, LC: Local Council, SA: Statutory Authority, IR: Independent Regulator, GC: Government Corporation, O: Other, Pr: Private Sector; **Level –** Commonwealth, State, Local, Commonwealth/State, State/Local, Sub-state, Private (Decentralised)

Commonwealth

The role of the Commonwealth government in EWF has varied across sectors, despite having no formalised constitutional responsibility for EWF. In the early periods, through its power over trade and external affairs, the Commonwealth was involved in matters of mining and agriculture (export industries), but its involvement in energy and water (state and local concerns) were otherwise limited. During the reform period, while the Commonwealth withdrew much of its direct involvement in agriculture and food sectors (dismantling of statutory marketing arrangements, reduction of assistance, tariffs reduction), its involvement in the energy and water sectors rose in response to the oil crisis, water resource scarcity and environmental degradation. Each sector underwent a series of reforms coordinated by the Commonwealth.

Much of the Commonwealth's role in the EWF sectors has, over the last several decades, been in national policy-making and legislation. The Commonwealth government, following reform, is not directly involved in the operation of sectors nor does it promote the direct involvement of state governments in those sectors.

The analysis of the Commonwealth's involvement in EWF has shown that its scope for influencing sectors over time has varied. For example, during the post-war period, the government had a great scope in influencing the food sector while it had almost no scope in influencing the energy (aside from mining) and water sector (although with an indirect influence as a result of its influence in the food sector). While the reform era represented a time in which the Commonwealth played a similar role in EWF sectors in driving reforms, in general, its involvement in EWF reflects treatment of EWF as mostly separate domains.

The Commonwealth's capacity to influence the integration of the EWF sectors has been limited as a result of the differences in scope it has had in terms of influence. Currently, its capacity to influence integration between EWF is through its ability to make national policy in all EWF areas and its ability to coordinate states, as seen in the National Competition Policy, National Water Initiative and the management of the Murray-Darling Basin. The intersection of water priorities and food priorities (from the conservation of water and water for the environment) as well as enhancing agricultural growth and agricultural competitiveness, gives rise to the need for the Commonwealth's involvement. Promoting water use efficiency in industry and the development of the National Water Initiative have been ways of encouraging integration between the sectors, however there has only been partial integration of the water and food sectors.

The limitation of the Commonwealth's capacity to influence the integration of EWF is that, as the highest level of government, it is the most distant from understanding the local impacts of

EWF interactions. The opportunity for the Commonwealth to promote integration between EWF is through the coordination of states where the greater responsibility of integrating EWF rests.

New South Wales

Government involvement in EWF has varied over the time periods in NSW with differences in the level of government involvement across sectors. While mining and agriculture were matters for state government departments responsible for policy, legislation, regulation and assistance, differences in government involvement across EWF sectors were seen in the electricity, gas and water sectors.

Government involvement in the electricity sector evolved over the years from initially, the governance of a mostly decentralised electricity sector that was under the responsibility of local governments and private businesses in the early periods, to a centralised system during the late 1930s, governed by the NSW State Electricity Commission and the NSW Electricity Authority and by the 1990s, to a corporatized sector that was finally privatised in 2015.

Also developing locally and then undergoing centralisation was the water sector (water supply, sewerage and drainage and irrigation). Government involvement varied across the different water sector industries, ranging from local council responsibility to the responsibility of large statutory authorities in metropolitan areas (boards) and for irrigation (water commissions), to finally, the responsibility of government departments in the 1980s. Currently, the electricity sector is mostly privatised with regulation in transmission networks. Water supply bodies comprise government-owned corporations.

The analysis of the government in NSW identified differences in government involvement between EWF sectors and over time, this has suggested that the government has had limited capacity to influence the integration of EWF. While agricultural and mining matters have been dealt with at the state government level, electricity and water matters have been the responsibility of local authorities and multiple and autonomous regional authorities. In the water sector, separate authorities have been responsible for metropolitan water and rural water. Recently, the energy sector has become predominately private.

EWF have been governed by various types of authorities. At the state level, EWF have been treated separately over time, under the control of sector-specific authorities. The agricultural sector was also governed by a number of statutory marketing authorities.

With more influence in some sectors than others, opportunities to integrate EWF have been limited. For example, with little scope to influence the privatised electricity sector, it is therefore difficult for the government to integrate electricity with its control over water and food.

Victoria

Government involvement in Victoria in EWF has varied over the periods. Centralisation in water and electricity occurred within the first two decades after federation through the creation of the State River and Water Supply Commission (1906) and the State Electricity Commission of Victoria (1919), which was responsible for unifying, respectively, the water and electricity sector developments at the state level. While both the water and electricity sectors were initially local concerns, they were soon state-level concerns. Gas, however, remained a private concern.

In the 1990s, government involvement in the EWF sectors diverged, particularly as the electricity sector was privatised in the 1990s, reducing the scope of the government to influence the sector. Water remained a government responsibility under state water departments, the metropolitan board and more recently, the state-owned water corporations. Agriculture and food matters remained the responsibility of state departments with the involvement of statutory marketing authorities during the post-war period.

The analysis of the government in Victoria shows that until the 1990s, government involvement was similar in both the electricity and water sectors as they were governed by large state commissions, which at the time, may have suggested possibilities for integrating both the energy and water sectors. The government had a similar scope in influencing both sectors. Both commissions, however, undertook sector-specific duties hence, there was little integration of EWF responsibilities.

The capacity for the government to influence EWF now varies across the sectors. While there is scope for the government to influence the water sector, there is less scope for the government to influence the electricity sector and the agricultural sector, the latter of which involves private activity. Hence, the integration of the sectors is limited as the government cannot exercise the same level of control in all sectors.

Queensland

Similar to the other Australian states, electricity and water developed locally while agriculture and mining were state government matters. Electricity was supplied initially by local councils (Brisbane City council) as well as the Metropolitan Electricity Board. Water supply and sewerage were the responsibilities of the Metropolitan Water and Sewerage Board from 1909, and the Brisbane City Council and its departments.

Centralisation took place in energy in the late 1930s with the establishment of the State Electricity Commission. Water supply and irrigation responsibilities were shared between the state's Commission of Irrigation and Water Supply and the Metropolitan Council's Statutory Water and Sewerage Board. Both the electricity and water sectors experienced further centralisation. This was seen in 1978, with the establishment of the Queensland Water Commission, and in 1985

when the State Electricity Commission and the Queensland Electricity Generation Board (est. 1976) joined to form the Queensland Electricity Commission. Currently, both electricity and water are governed by predominantly state-government-owned corporations and also local-government-owned retailers (in the water sector).

The analysis of government involvement in the EWF sectors in the state found that over time, electricity and water have been governed by similar levels of government, from local governments and boards to large state commissions in electricity and water. Agriculture and mining were both state concerns. The government continues to have an influence in these sectors. This suggests that with similar capacities to influence the EWF sectors, the government has had, as a result, opportunities to integrate the EWF sectors, even with the presence of market forces in both electricity and food sectors. Similar authorities have been responsible for energy and water, also during similar times (centralisation in the 1930s, 1970s and 1980s), although with separate responsibilities. The current government's capacity to influence the sectors, however, suggests that the Queensland government has greater scope to promote integration between sectors, than other states.

South Australia

The developments in SA were distinct from other states. Firstly, government departments had control over water resources since the early development of the water sector prior to federation. The Engineering and Water Supply Department and its previous government representatives were responsible for water up until the 1990s when other government departments were involved.

Although SA government departments were involved in water (as well as mining and agriculture) since the early development of these sectors, the electricity and gas sectors were largely private. The centralisation of electricity occurred in the mid-1940s when the Adelaide Electric Supply Company Ltd was nationalised out of fears of monopoly power (Lyn 2015), forming the Electricity Trust of South Australia (ETSA), established to coordinate electricity systems.

Unlike other states, water was the responsibility of a single government department body rather than various bodies, and unlike other states, a long-standing State Commission for electricity was not established. Up until the 1940s, government involvement across the sectors varied, with state government departments being responsible for water and food, contrasting with the private control of the electricity sector. Before the 1940s, the government had limited scope to influence the integration of the EWF sectors.

Opportunities for the integration of the EWF sectors, however, were seen after the 1940s as the government became involved in the electricity sector through the establishment of ETSA, converging the levels of government involvement with the other sectors. The state government

had opportunities to influence sectors through the large state bodies at the time (ETSA, the Engineering and Water Supply Department and the departments for mining and agriculture). However, these bodies had sector specific responsibilities.

Like other states (except for Queensland), the privatisation of electricity, however, altered the capacity for governments to influence the integration of EWF as the level of government involvement across sectors differs yet again.

Tasmania

In Tasmania, local and state government bodies had responsibilities in EWF sectors. A distinct characteristic of Tasmania, however, has been that, unlike other states, water and electricity were largely integrated and governed jointly as a result of the state's hydro-electric developments.

The Hydro-Electricity Commission established in the late 1920s was responsible for the provision of electricity as well as rights to water. The scope for integration was greater than the other states, particularly for energy and water. Further centralisation of water took place in the 1950s.

Similarities in the level of involvement in EWF has meant that the Tasmanian government has, over time, had scope to integrate the sectors. As the government maintains a level of involvement in the sectors (Hydro Tasmania, the state's main electricity provider remains government owned), there is scope for integration.

Western Australia

In WA, the level of government involvement in water and energy has been similar. Electricity was the responsibility of government departments in the early years before the establishment of the State Electricity Commission in 1945, following the establishment of similar authorities in other states. Water was also the responsibility of government departments as well as a metropolitan state authority. In the 1980s and 1990s, two state authorities were established (Water Authority and the Water and Rivers Commission). Currently, state-owned entities are the primary providers of water and energy in the state.

In WA, the level of government involvement across sectors (although there are private mining interests) has been largely constant with the state government playing a role in the sectors over the years. The government has utilised similar organisations and authorities for both water and energy including water and electricity commissions, although with separate responsibilities. With similar levels of influence in EWF, there has been scope for promoting integration between EWF sectors.

Northern Territory and Australian Capital Territory

In the Northern Territory and the Australian Capital Territory, government involvement in both the energy and water sectors has been similar. Energy and water, in particular, have been governed jointly through bodies such as the Power and Water Authority and the PowerWater Corporation in the NT, and the ACT Electricity and Water (ACTEW Corporation) in the ACT.

The scope for integrating sectors (at least energy and water) has been possible, and the government has played a similar role in governing and providing electricity and water. In the ACT, food, however, has not appeared to be a priority and no particular department is dedicated to agricultural and food matters. This limits the consideration of food linkages.

6.2.3 Main Points

The main points of the analysis are:

Trends in government involvement

- Government involvement has varied across EWF sectors, across states and over five time periods.
- Increasing levels of government involvement were evident in EWF sectors during the periods, particularly after federation. Although agriculture and mining were usually dealt with by state governments, through its powers over trade and exports, the Commonwealth also played a role in the sectors. Electricity, gas and water services were originally decentralised, controlled and provided by local governments and private companies.
- From the early 1900s, energy and water sectors underwent a process of centralisation. A key feature included the establishment of large government statutory bodies responsible for development, regulation and service provision, responsible to relevant state ministers. Such statutory authorities were established to undertake sector-specific duties. Large statutory authorities included State Electricity Commissions, State Water Commissions, Regional Water Boards as well as various statutory boards in charge of marketing of a number of rural products, ranging from national-based boards such as the Australian Wheat Board and the Australian Meat Board to smaller state-based boards.
- The government, during the first three periods, influenced all aspects of policy and development, regulation and service provision. Commonwealth, state and local governments had shared responsibilities. The economic reforms starting in the 1970s sought to alter the nature of government involvement through deregulation, privatisation and the introduction of competition, with changes to the mix of public and private involvement and responsibilities, now largely reduced to policy and development. Regulation is a responsibility of independent

regulators, and the government has fewer responsibilities over the provision of services in food (no longer responsible for marketing or sale with the dismantling of some statutory marketing authorities) and electricity (through the privatisation of government-owned utilities). The provision of water services, however, has remained a public responsibility while irrigation services, however, were also operated by private interests.

- In previous periods, these responsibilities (policy, regulation and provision) were intertwined and part of the government's responsibilities. The separation of these responsibilities, however, may have sought to limit the potential of political interference in these sectors.
- While there was a shift towards reduced government involvement, there was greater centralisation in EWF policy at the Commonwealth level, evident by the growth in national policymaking in EWF areas.

Differences between jurisdictions

- Although the centralisation of both water and electricity systems occurred at different times across the states, it occurred in all states, highlighting the common desire for coordinated and unified electricity and water sectors, sectors that initially developed at the local level.
- The large state authorities, established as a result of centralisation, however, were specific to carry out sector-specific duties (except for Tasmania's Hydro-Electricity Commission which was responsible for both electricity and water).
- One of the differences in government involvement across the states was seen in the processes of centralisation in electricity and water supply. The creation of large statutory authorities responsible for electricity and water supply varied. Victoria, for example, was the first to establish a State Commission for water and electricity, establishing the State Rivers and Water Supply Commission in 1905 and the State Electricity Commission in 1918, while other states established similar commissions in the years later. For example, it was not until 1946 that SA established a similar large centralised government authority for electricity. In SA, water remained centralised under the Public Works Department. It was the only state to have one single body predominantly responsible for water, while in other states, sector responsibilities were shared by multiple authorities. For example, metropolitan water supply and rural water were the responsibility of separate large authorities.
- The processes of privatisation in the electricity sector differed amongst the states. Victoria was the first to privatise the electricity industry while other states such as Queensland maintained government control. The levels of government involvement, particularly in the electricity sector, differed between states. Differences in government involvement varied mostly between each state's electricity sector while government involvement in water and food were similar.

Scope for EWF integration

- The differences in the level of government involvement and the scope the government has in influencing the sectors may explain the limited capacity for governments to integrate EWF sectors and govern the sectors jointly, explaining the separate treatment of the sectors. The analysis shows that there were differences in the scope that governments had in influencing EWF sectors, particularly as a result of public and private involvement. For example, while the Victorian government still has scope in the provision of water, it does not have scope in the provision of electricity or food which are both provided under competitive markets. Hence, the government is limited by its scope to jointly govern all three EWF sectors and the provision of EWF. While an increase in government involvement may enable integration, such change may be difficult particularly since reforms, underpinned by neoliberal ideologies, sought to reduce the government involvement and areas of market distortion.
- It is furthermore difficult to integrate responsibilities across one tier of government when responsibilities and involvement are shared and allocated vertically along the tiers of government. The analysis also showed how responsibilities were shared between both state and local governments and this varied across states. Sharing of responsibilities across levels of government, however, may also lead to confusion regarding the roles and responsibilities that each level of government has in EWF, and this could also lead to conflict, overlap and inefficiencies. The centralisation of EWF may have provided a setting in which sectors could be integrated.
- The distribution and sharing of EWF responsibilities between state and local levels and between authorities (departments, boards, local councils) and the involvement of the government in the sectors varies across the states and territories, as described. This poses challenges for dealing with transboundary EWF-related issues as it may create state vs state tensions and impact on the ability of the national government to harmonise EWF policies. EWF sectors are subject to both Commonwealth and state legislation.
- The Commonwealth government's role in national EWF policy and in fostering intergovernmental cooperation and coordination may provide opportunities for integration at a higher level. However, there are limits to the extent to which the Commonwealth can influence integration. Scale is an important consideration as the physical linkages of EWF are often visible at local levels, and EWF issues can be localised. For instance, the impacts of drought, blackouts and price differences in regional areas are felt locally. Communities located in areas threatened by the negative impacts of contamination due to gas developments is another example of localised impacts. While the centralisation of powers and authority may foster the integration of responsibilities between sectors, the higher the level of authority, the

higher the risk of not being able to properly govern localised issues. There is a need for all levels to be responsible and not to suggest a bias towards one level of government.

- The involvement of the Commonwealth government in EWF, however, also reflects the influence of the Commonwealth government in matters that were not constitutionally allocated to it, and this may result in potential problems of sharing responsibilities that are not defined in the constitution.[12] For example, as the Commonwealth government assumes a greater role in EWF policy-making, it may interfere with the interests of states, encroaching upon and limiting the states policy-making responsibilities to make decisions more appropriate for their jurisdiction.
- Therefore, it is important to consider the scope of government responsibilities. The Commonwealth may have a role in promoting integration at a higher level and coordinating states while the implementation of integrated policies occurs at the state level. Currently, the integration of EWF does not take place at the Commonwealth level, as seen in the lack of cross-sectoral platforms by which EWF can be dealt with together, e.g. ministerial councils. Expanding the scope of one level of government into the areas of another level of government (expanding Commonwealth powers in areas of state governments) may furthermore be difficult. Implementing changes in powers and responsibilities may further require changes to legislation.
- The analysis of government involvement in EWF highlights the issues of governing across sectors associated with both the scope of government responsibility and the scale of government authority (federal, state and local levels).

6.3 Conclusions

This chapter analysed Level 1 and Level 2 institutions, looking at the development philosophies that have shaped Australia's socio-economic development, and the government, including intergovernmental relations (financial dependency and intergovernmental coordination) and government involvement (centralisation, private and public mix, government responsibilities).

The first section examined development philosophies highlighting the transition from colonial socialism and Keynesianism towards neoliberalism, with implications on the nature of government involvement in the economy and in EWF sectors. It also highlighted the heightened environmental awareness of the recent decades which have influenced EWF policies

[12] The Tasmanian Gordon-Below Franklin Dam case is an example of this, showing how state powers to influence its energy and water sectors through its proposal to construct a dam were overridden by Commonwealth powers, which rejected the construction due its potential to undermine the environmental protection of the area, a matter under the Commonwealth's power (Head & Patience 1989).

The second section covered government characteristics and functions. This section examined intergovernmental relations and discussed the financial dependency of the states on the Commonwealth. Through special grants, the Commonwealth Government could influence developments in the states, particularly in water. Intergovernmental coordination between the tiers of governments was then discussed and showed how intergovernmental coordination has become an important feature of policy making and implementation, particularly in EWF. It noted the rise in intergovernmental agreements and intergovernmental ministerial councils particularly dealing with EWF matters but found that coordination and cooperation mostly occur on a sector-by-sector basis. There has been little evidence of both inter-sectoral and intergovernmental coordination where integrated EWF policy and approaches could be facilitated.

The second section next analysed the changes in government involvement in EWF sectors to understand the scope in which governments, over time, could influence the sectors and in particular, influence integration between sectors. The main points are as follows:

- The analysis found that government involvement in EWF sectors has varied over the five time periods and across the states. After federation, increasing levels of government involvement were evident in EWF sectors, seen in the centralisation of electricity and water sectors (originally local government and private concerns) and dominance of the Commonwealth government. While agriculture and mining sectors were predominantly state government concerns, the largest change in government involvement was seen in electricity and water sectors. Although the centralisation of electricity and water enabled the levels of government involvement in EWF sectors to converge, raising the scope that governments had to influence EWF sectors and integration, the levels of government involvement across EWF sectors soon diverged. Economic reforms reduced the direct involvement of the government in the electricity and food sectors, and in some states electricity was privatised, limiting the scope of governments to influence electricity operations. The provision of services was no longer a government responsibility. As a result, the capacity of governments to influence the integration between EWF has been limited.
- The analysis observed the differences in involvement across the tiers of governments (Commonwealth, state and local governments) and how EWF responsibilities have been shared. While state government departments have played a key role in governing EWF matters, the role played by large statutory authorities and local governments was also significant.
- The differences in the capacity of government (federal, state and local) to influence EWF sectors, as reflected by the extent of government involvement (with respect to the private sector) and responsibilities, determine the extent to which EWF have been integrated. In

particular, the more minimal the role of the government in a sector, the less scope it has to encourage integration.

- The scope of responsibilities according to each level, however, was not clear and as the analysis noted, despite having no formalised responsibility as specified by the constitution, the Commonwealth has played a greater role in EWF. Unclear division of roles and responsibilities between the Commonwealth and states however may lead to the confusion of roles, possible overlaps, inefficiencies and tensions.

The analysis above shows the complexity of governing EWF sectors, the differences and similarities in each sector and the opportunities for government to influence integration.

Chapter 7 Portfolio Representation, Ministerial and Organisational Responsibilities in EWF

This chapter examines the extent to which the institutional settings of portfolio representation, ministerial and organisational responsibilities integrate EWF matters over the five time periods.

The chapter is divided into six sections. Section 7.1 describes portfolio representation; Section 7.2 describes ministerial responsibilities and Section 7.3 describes departments (organisations) responsible for EWF matters. Section 7.4 analyses the extent of integration of EWF along the decision-making chain, from portfolios to the allocation of portfolios to ministers, to government department responsibilities[13]. Section 7.5 provides a discussion on the findings and Section 7.6 provides a summary of the main findings and conclusions.

7.1 Portfolio representation

A government portfolio represents a minister's area of government responsibility as members of Cabinet (Australian Government 2018). Government portfolios represent areas of government concern and matters in which the government is involved. They are shaped by the wider government agenda that influences the way responsibilities are separated and grouped together. Changes in portfolios reflect changes in government responsibilities and priorities and may change upon new governments coming into power to reflect a new government agenda and a new set of priorities. In Australia, such changes are part of what is referred to as the Machinery of Government (MoG) changes, 'when the Government decides to change the way Commonwealth responsibilities are managed'(Australian Public Service Commission 2018, para. 1). This can 'involve the movement of functions, resources and people from one agency to another' (Australian Public Service Commission 2018, para. 1).

From the mid-1850s, with the introduction of self-government and the formation of state governments, until the present, a number of portfolios have been created for EWF matters. Over the five time periods, it is found that the portfolio representation of EWF matters has evolved

[13] The political parties analysed over the periods have been grouped into two: Labor and non-Labor parties. This borrows from classification used in Moon and Sharman (2003). The grouping is used to aid the ease of exposition for brevity given the diverse range of political parties that have existed over Australia's history. This grouping by no means reflects any political preference by the author.

considerably, demonstrating changes in the wider government agendas and its priorities in relation to EWF. Portfolio titles have also varied to reflect the way EWF issues have been framed.

This section examines the representation of EWF-related portfolios as a means of identifying the extent to which EWF issues have been considered areas of government concern, represented as areas of responsibility and reflected as priority matters of the government.

Similar to Hughes (1984), the portfolio titles used are official in the sense that they are the ones which appear in Government Gazettes and the front pages of Government Hansard. However, unlike Hughes (1984) who breaks down double- and triple-barrelled portfolio titles, in this research, portfolio titles are taken into consideration in the way they are listed. For example, the Minister for Mines and Water Supply is considered to be responsible for a mixed portfolio rather than separate portfolios. A minister holding two titles such as a Minister for Mines and Minister for Water Supply is considered to have two portfolios although both are the responsibility of one minister. The reason for this is that this may have implications on future designations. For instance, Minister A is Minister for Mines and Water Supply. When the following Minister, Minister B, inherits the portfolio for mines and water supply, there is no change in portfolio responsibility, only a change in the person in charge. When Minister C is Minister for Mines and Minister for Water Supply, the succeeding minister may inherit both portfolios, or two ministers may inherit one each, thereby considered separate portfolios. The change in portfolio responsibility is not only a change of persons but also a potential change in responsibilities where portfolio responsibilities may be split between two different ministers. These splits in portfolio responsibilities, however, are important because they affect the integration of EWF responsibilities.

7.1.1 Portfolio creation

At the beginning of self-government, state cabinets comprised a small number of government portfolios but since then, the number of government portfolios has grown (Moon & Sayers 1999). Table 7.1 and Table 7.2 show the creation of EWF-focused portfolios (single-sector portfolios) and mixed portfolios (multiple-sector portfolios) combining matters of energy, water or food. Table 7.1 shows where, when and by which political party EWF portfolios were *first* created across the jurisdictions. Table 7.2 lists the first portfolios created in each state.

Table 7.1: Creation of EWF Portfolios – First introduction

Portfolio		Jurisdiction	Year of creation	Political party
Sector-specific portfolios	Mines, Mining	Victoria	1866	*Non-party*
	Energy	Victoria	1927	Australian Labor Party
	Water	Victoria	1880	Conservatives
	Food (Agriculture)	Victoria	1871	Ministerialists
Mixed-sector portfolios	Energy-Water	Victoria	1880	Conservatives
	Energy-Food	Victoria	1883	Conservatives
	Water-Food	Victoria	1881	Ministerialists
	Energy-Water-Food	Commonwealth	1987	Australian Labor Party

Source: Author's compilation from data sources listed in Appendix D

Table 7.2 shows that prior to federation, Victoria had created almost all single-sector and mixed-sector portfolios and three of its six portfolios were created by conservative parties. The Commonwealth was the first jurisdiction to introduce a portfolio combining EWF matters.

Mining-related portfolios were part of the first government portfolios created prior to federation in each state, reflecting the importance of mining developments during the 1800s. The first mining portfolio was created in Victoria in 1866. The creation of agriculture-specific portfolios (although Lands portfolios did exist) were created in later years and only in South Australia did an agriculture portfolio precede the creation of a mining portfolio. The creation of water-related portfolios followed, although water was subsumed under broader portfolios such as those for public works, environment and conservation.

The development of portfolios varied across the states. In New South Wales, for example, the first mining portfolio was created in 1872, which in 1891 was combined with agriculture to form the Mines and Agriculture portfolio. While a conservation portfolio was created in 1947 to include water responsibilities, the first portfolio specifically representing water matters was created in 1975 (a number of years after the creation of other mining and agriculture portfolios) and was called the Water Resources portfolio. Water management issues were likely subsumed into other portfolios not specific to water. In 1971, the government created the Power portfolio and in 1975, the first Energy portfolio. While agriculture and mining have been government portfolios prior to federation, it was only in the 1970s that energy and water matters were represented as portfolios, reflecting the priorities of the government.

In Victoria, its first mining portfolio (as mentioned) was created in 1866, followed by an agriculture portfolio in 1875, and lastly a portfolio for water supply in 1881. Portfolios representing EWF were created prior to federation, reflecting the importance of mining, agriculture and water issues in earlier periods. After federation, the government created a portfolio specifically for the state's Wheat Scheme (1924), followed by a portfolio for electrical undertakings in 1927. Years later in 1967, the government created the Fuel and Power portfolio.

In Queensland, portfolios for mines and agriculture were similarly created prior to federation, in 1874 and 1893, respectively. In 1950, the government created the Lands and Irrigation portfolio, representing the water-food linkages in irrigation. The first portfolio specifically created for water was the Water Resources portfolio in 1975. The first non-mining energy portfolio was the Local Government and Electricity portfolio in 1969, followed by the combined Mines and Energy portfolio in 1975.

In South Australia, a portfolio for agriculture was created first (before mining portfolios) in 1875, which was then combined with irrigation in 1912 and in the same year, a mines portfolio was created. In 1905, the Water Supply portfolio was created. The Mines and Energy portfolio was created in 1970, many years later.

In Tasmania, a mining portfolio was created in 1899, followed by an agricultural portfolio in 1903. The first water-specific portfolio was created in 1978 called the Water Resources portfolio. However, a portfolio for the Hydro-Electric Department, grouping water and electricity responsibilities, was created in 1934. The Resources and Energy portfolio was, like other states, created in 1975.

In Western Australia, its mines portfolio was created in 1894, followed by an agricultural portfolio in 1904. The Works and Water Supply portfolio and the Sewerage and Drainage portfolio were created in 1911. The first non-mining energy portfolio, the Electricity portfolio was created in 1962.

Government portfolios in the Northern Territory and the Australian Capital Territory were created soon after self-government in the late 1970s and late 1980s, respectively. The first energy portfolio in the NT was the Resources Development portfolio in 1974, followed by the Mines and Energy portfolio in 1978. Portfolios for water included the Water and Power portfolio¸ created in 1995 which was combined with energy responsibilities. Earlier water portfolios were those associated with natural resources and the environment. Food-related portfolios included the primary industry portfolios, created in 1974. In the NT, the Essential Services portfolio covered both energy and water responsibilities. In the ACT, portfolios differed to other states, with broader portfolios containing EWF-related matters, such as the Urban Services portfolio for energy and water and health portfolios for food, respectively. No specific agricultural portfolio was created

in the ACT. In 2008, the government created the first energy portfolio. In 2007, the Environment, Climate Change and Water portfolio was created, representing water and also energy-related responsibilities.

At the Commonwealth level, the first specific food-related portfolio was the Commerce and Agriculture portfolio, which was created in 1941 in line with the importance of food policy and controls in the country during World War II. Portfolios related to fuels were created in 1949 and 1950 and only in 2007 was the first portfolio for water created, the Environment and Water portfolio. This was in line with the increasing role of the Commonwealth in managing water issues, particularly during the millennium drought.

Table 7.2 shows how the creation of portfolios for EWF varied across time, with the first portfolios developed for mining and agriculture, reflecting mining and agricultural priorities in the early periods. Water portfolio creation also varied across the states, with Victoria and SA being the first states to create water specific portfolios in the late 1800s and the early 1900s, respectively. The creation of water portfolios occurred in later periods in other states, suggesting that water issues may have only become a government priority for these states during the 1960s and 1970s, and for the Commonwealth, in 2007, although it is important to note that water is a state rather than Commonwealth concern. Another pattern that was evident was the creation of non-mining energy portfolios in 1970s, in line with energy security concerns at the time.

Table 7.2[14] also shows the timing of the creation of portfolios in each state and the political party in government which was responsible for such creation. The table shows that in most states, non-Labor governments were responsible for the creation of the majority of sector portfolios. Only in Queensland, WA and the ACT were the majority of portfolios created by Labor governments.

The portfolio representation of EWF appears symbolic of the governments' attention to EWF matters. The creation of EWF-related portfolios in the early periods shows the importance of EWF matters as areas of government concern, mainly at the state level.

[14] Political party codes are used in each table. The legend is as follows: ***Political Parties:*** **ALP:** Australian Labor Party**; CLP:** Country Liberal Party; **CON:** Conservative Party; **COU:** Country Party; **CPNP:** Country & Progressive National Party, **ER:** Electoral Reform League, **FT:** Free Trade; **LCL:** Liberal and Country League Party, **LIB:** Liberal Party; **LNP:** Liberal National Party; **MIN:** Ministerialists; **NAT:** National/ Nationalist Party; **NAT LAB:** National Labor Party; **NAT PROG:** Nationalist-Progressive Party; **PROT:** Protectionist Party; **REF:** Reform; **SUP:** Support from parliamentary factions and independents; **UAP:** United Australia Party; **UCP:** United Country Party, *Source:* Australian Politics and Elections Database, The University of Western Australia (2018)

Table 7.2: Creation of EWF portfolios by state

JURISDICTION		SINGLE SECTOR PORTFOLIOS			MIXED SECTOR PORTFOLIOS			
	Self-government	**Energy (Mining and non- Mining)**	**Water**	**Food (Agriculture)**	**Energy-Water**	**Energy-Food**	**Water-Food**	**Energy-Water-Food**
COM	1901	1948 Shipping and Fuel (ALP) *1923 Home and Territories (NAT-CP)*	2007 Environment and Water Resources (LIB)	1942 Commerce and Agriculture (ALP) *1910 Trade and Customs (ALP)*	1932 Interior (UAP) 1950 National Development (LIB-CP)	*2013 Industry (LIB-NP)* *1934 External Affairs (UAP)*	1998 Agriculture, Fisheries and Forestry (LIB-NPA)	1987 Primary Industries and Energy (ALP)
NSW	1856	1874 Mines (SUP) 1972 Power (LIB) 1975 Energy (LIB)	1944 Conservation[a] (ALP) 1975 Water Resources (LIB)	1908 Agriculture (LIB REF) 1953 Food Production (ALP)	*1899 Public Works (PROT)* 2003 Energy and Utilities (ALP)	1891 Mines and Agriculture (PROT)	-	-
VIC	1855	1866 Mines (MIN) 1912 Electrical Undertakings (ALP)	1880 Mines and Water Supply (CON) 1886 Water Supply (CON)	1871 Lands and Agriculture (MIN) 1991 Food and Agriculture (LIB NAT)	1880 Mines and Water Supply (CON)	1885 Mines and Agriculture (CON) 1996 Agriculture and Resources (LIB NAT)	1881 Public Works. Agriculture and Water Supply (MIN)	-
QLD	1859	1874 Public Works and Mines (MIN) 1960 Development, Mines, Main Roads and Electricity (COU)	1950 Public Lands and Irrigation (ALP) 2006 Natural Mines and Water (ALP)	1893 Public Lands and Agriculture (MIN) 2001 Agriculture, Food and Regional Economies (ALP)	2004 Natural Resources and Mines (ALP) *1874 Public Works and Mines (MIN)*	-	1950 Public Lands and Irrigation (ALP)	-
SA	1856	1914 Mines (LIB) 1975 Mines and Energy (ALP)	1857 Public Works (MIN) 1905 Water Supply (ALP)	1875 Agriculture and Education (MIN) 2002 Agriculture, Food and Fisheries (ALP)	-	2001 Primary Industries and Resources (LIB)	1912 Agriculture and Irrigation (LIB)	-

JURISDICTION		SINGLE SECTOR PORTFOLIOS			MIXED SECTOR PORTFOLIOS			
	Self-government	**Energy (Mining and non- Mining)**	**Water**	**Food (Agriculture)**	**Energy-Water**	**Energy-Food**	**Water-Food**	**Energy-Water-Food**
TAS	1856	1899 Mines (MIN) 1975 Resources and Energy (ALP)	1928 Hydro-Electric Department (NAT) 1978 Water Resources (ALP)	1903 Agriculture (MIN)	1928 Hydro-Electric Department (NAT)	1992 Primary Industry, Fisheries and Energy (LIB)	2004 Primary Industries and Water (ALP)	2008 Primary Industries, Water and Energy (ALP)
WA	1890	1894 Mines and Education (FOR) 1959 Electricity (LIB)	1913 Works and Water Supply; Sewerage and Drainage (ALP)	1905 Agriculture (ALP) 2005 Agriculture and Food (ALP)	1914 Mines and Water Supply (ALP)	1924 Mines and Agriculture (ALP) 1962 Agriculture and Electricity (LIB)	-	-
NT	1978	1974 Resource Development (CP LIB) 1978 Mines and Energy (CP LIB)	1984 Conservation (CP LIB)	1974 Primary Industry (CP LIB)	1995 Power and Water (CP LIB)	2009 Primary Industry, Fisheries and Resources (ALP)	-	-
ACT	1988	2008 Energy (ALP)	2007 Environment, Water and Climate Change (ALP)	*2001 Health (ALP)*	*1991 Urban Services (ALP)*		*1991 Environment, Land and Planning (ALP)*	*1989 Housing and Urban Services (ALP)*

Source: Author's compilation from data sources listed in Appendix D

Note: Public Works and Local government portfolios are assumed to entail energy and water-related responsibilities, and Lands portfolios are assumed to entail mining, agriculture and mining-related responsibilities. Portfolio names in italics are broad portfolios that include energy, water and food matters, a) The Conservation portfolio is considered to represent water portfolios as seen in Hughes (1984)

7.1.2 Evolution of portfolios

Portfolios for EWF evolved, either taking on different names, being combined with other portfolios or being subsumed into broader portfolios. The titles often reflected different themes, indicating the way in which such areas of responsibility were framed, for example, energy portfolios included resource-based and industry-related portfolios, while food portfolios included agriculture or primary industry portfolios. While water-sector focussed portfolios existed, water was often a responsibility of a portfolio dealing with the environment, conservation and natural resources. These themes often reflected differences in priorities. Table 7.3 provides some examples of alternative portfolio titles that were created.

The portfolio representation of EWF across the periods indicates the level of priority given to EWF matters, with an emphasis on specific EWF matters. Energy portfolios varied from specific energy sector portfolios, such as mining, resources and electricity portfolios, to broader multi-sectoral portfolios, such as national development-focused portfolios, industry-based portfolios and, in more recent times, environment-focused portfolios such as the Commonwealth government's recent Environment and Energy portfolio and the previous Climate Change portfolio. This indicates the importance of environmental themes in the context of energy policy and, vice versa, the importance of energy in the context of environmental policy. This recognises the relationships between energy and the environment, for example, carbon emissions and climate change. Other portfolios included technology-focused portfolios.

As mentioned, the first energy-related portfolios were mining portfolios, followed by non-mining energy portfolios, for example, the portfolios for electrical undertakings, and fuel and power in Victoria (1927 and 1967) and electricity portfolios in WA and Queensland (late 1950s).

Table 7.3: Portfolio titles created

Sector	Portfolio	Year Introduced	Jurisdiction	Party
Energy	Energy, Energy Resources	1972, 1975*	Tasmania, NSW	Liberal
	Mines, Mineral Resources	1866	Victoria	Ministerialists
	Energy and; Mines or Minerals or Mining	1972	Commonwealth	ALP
	Energy and; Resources, Resources Development	1975	Tasmania	ALP
	Electricity, Electrical Undertakings	1912	Victoria	ALP
	Fuel, Power	1948 1974	Commonwealth WA	ALP Liberal

Sector	Portfolio	Year Introduced	Jurisdiction	Party
	Energy and Utilities	2003	NSW	ALP
	Industry-related portfolios	1985	Victoria	ALP
	Energy and Environment	2016	Commonwealth	Liberal
Water	Water, Water Supply, Water Resources	1880, 1893*	Victoria	Ministerialists
	Water Utilities	2012	Queensland	ALP
	Water Security	2006	SA	Liberal
Food	Agriculture	1871, 1892*	Victoria	Ministerialists
	Agriculture and; Fisheries and/or Forestry	1975	Tasmania	ALP
	Food, Food Production, Agriculture and Food	1953	NSW	ALP
	Food Security	2010	Victoria	Liberal
	Agriculture and Irrigation	1912	SA	Liberal
	Agriculture and Rural Affairs	1985	Victoria	ALP
	Primary Industry, Primary Industries	1956	Commonwealth	Liberal
Other themes	Climate Change	2006	Queensland	ALP
	Natural Resources	1984	NSW	ALP
	Environment	1971	Commonwealth	Liberal

Source: Author's compilation from data sources listed in Appendix D

Note: *First 'Energy', 'Water', 'Agriculture' portfolio

At the Commonwealth level, from the 1950s, energy along with water was under the National Development portfolio. All states (except the ACT) had an energy portfolio by the mid-1970s. In the 1970s, energy-titled portfolios, seen first in the Commonwealth, were considered timely and in anticipation of the energy crisis (Hughes 1984). In the late 1980s, energy was combined with water and food under the Primary Industries and Energy portfolio, a mixed sector portfolio (an important portfolio reflecting the integration of EWF responsibilities). During the Howard Liberal government from 1998, at the Commonwealth level, energy matters were part of industry portfolios and by 2010, part of climate change portfolios created by the Rudd and Gillard Labor governments. Energy was then transferred to the Resources and Energy portfolio before being made part of the industry portfolios again from 2013 until finally transferred to the environment portfolio in 2015 to form the Environment and Energy portfolio.

In NSW, energy portfolios were represented by specific resources, minerals and energy portfolios including the Energy and Technology portfolio (1986), the Industry, Resources and Energy portfolio (2015) and the Energy and Utilities portfolio (2003). In Victoria, energy was represented

under an industry-based and manufacturing-based portfolio in the mid-1980s to the 1990s. In Tasmania, energy was represented by the State Development and Resources portfolio in the early 1990s, previously combined under hydroelectricity-related portfolios. The creation of electricity portfolios in Victoria and Tasmania reflected the importance of electricity as an important issue confronting the states which had lacked coal resources (Hughes 1984). Most changes in portfolio names and themes were in the formation of energy portfolios rather than other water and food-related portfolios.

Water portfolios varied from specific water supply, water resource portfolios to broader portfolios, including natural resource and land portfolios, public works portfolios, to irrigation-based portfolios, conservation-oriented portfolios and environmentally themed portfolios such as climate change and sustainability. Other water portfolios included the Water Utilities and Water Security portfolios in SA, reflecting water security as a main concern. In SA, the River Murray portfolio was created, however this was absent in the other River Murray states, NSW and Victoria. Differences in portfolios suggested a role for water both for growth and development as well as its importance as an environmental asset.

Water portfolios were also distinct from the other portfolios in that there were times where water was its own portfolio and times when there was no obvious water portfolio, with water responsibilities either grouped under portfolios for primary industries or agriculture, environmental or conservation portfolios, or natural resource-related portfolios. This was seen in Queensland when water from 1989 was part of the Primary Resources portfolio until 1996 at which time water responsibilities were transferred to the Natural Resources portfolio (QLD Department of Natural Resources 1996). The different water responsibilities associated with irrigation and rural water along with responsibilities over water supply, sewerage and drainage and dams were split between portfolios, demonstrating some fragmentation within the sector. As Hughes (1984) describes, in WA, water portfolios included the Metropolitan Water Supply portfolio and the Goldfields and Agricultural Water Supplies portfolio (1927-1933). Groundwater responsibilities were often part of mining responsibilities.

The transferral of water responsibilities between environmental portfolios and agricultural portfolios seen at the Commonwealth level demonstrates changes in priorities. When water was part of the environmental portfolio, this indicated an emphasis on water for the environment and in the context of environmental policy. Its transfer to the agriculture portfolio reflects an emphasis on water for agriculture, dealt with in the context of agricultural policy and perhaps under a more exploitative agenda than that of the environmental portfolio.

Food-related portfolios were largely consistent, including agriculture-based and primary industries and industry-based portfolios, existent in all ministries since their creation in the 1880s,

suggesting an industry focus on food policy as opposed to social policy. In earlier periods, agriculture was also merged with education and mining. Specific rural portfolios were created in Victoria and Tasmania, including respectively, a portfolio for the Wheat Scheme during the 1920s and a portfolio for the Agricultural Bank in Tasmania in the 1930s. As Hughes (1984) describes, such portfolios reflected 'rural preoccupations' (p. 264) and other portfolios related to land and rural population, reflected the country's emphasis on primary production.

In the ACT, health portfolios covered food safety and agricultural matters subsumed under other portfolios. Other relevant portfolios included food-specific portfolios (where 'food' is in the title of the portfolio) such as the Food Production portfolio in NSW, Food and Agriculture and Food Security portfolios in Victoria, Food and Regional Economies and Food portfolios in Queensland, Food portfolio in SA and Agriculture and Food portfolio in WA. Agriculture was also combined several times with lands portfolios in WA, forming lands and agriculture portfolios. In SA, Water Security and Food Security portfolios were created highlighting security concerns at the state level.

The above discussion shows that there have been some differences in the presence of EWF portfolios over the periods. For example, food-related agricultural portfolios have typically remained prevalent ever since the formation of the federation. Mining portfolios were also part of governments' early portfolios, later combining with other energy-related portfolios, especially since the 1970s. Non-mining energy portfolios were first created in 1912 in Victoria, and in the late 1940s at the Commonwealth level. Water portfolios, however, have not been as constant a feature as food-specific and energy-specific portfolios, representing varying government priorities in relation to water.

7.1.3 Mixed portfolios

Table 7.4 provides a historic overview of mixed portfolios. Almost 40 mixed portfolios have been introduced across the jurisdictions over the years. Most two-sector mixed portfolios (energy-water, energy-food, water-food) were created when non-Labor governments were in power, while a few three-sector (EWF) mixed portfolios were introduced by Labor governments.

Combined EWF portfolios indicate some integration between EWF responsibilities. Combining energy and water responsibilities were broader titled portfolios including as mentioned, national development, national resources, public works and others including energy and water utilities, energy and water supply, natural resources and mines and mines and water supply. Combining energy and food were broad industry portfolios, such as the Primary Industries and Resources portfolio and other mixed portfolios such as the Agriculture and Electricity portfolio in WA and combined mines and agriculture portfolios. Water and food portfolios included mixed agriculture

and water resources portfolios and irrigation-based portfolios. At times, water was subsumed under agriculture portfolios.

At the Commonwealth level, in each of the four periods, there was at least one instance of EWF integration, including partial integration combining two sectors and full integration combining all three sectors. Full sector integration was seen at the portfolio level with one instance during the 1980s when EWF responsibilities were grouped in a single portfolio under the Primary Industries and Energy portfolio. In the first and second period, the integration of energy and water and energy and food responsibilities was evident under the Interior, Works, National Development portfolios (energy and water) and External Affairs portfolio (energy and food), respectively. During the third period, energy and water matters were seen in the first part of the period before the creation of the EWF portfolio. During the fifth period, water and food, and energy and food matters were combined.

At the state level, while EWF portfolios were represented across the periods, they were often separate portfolios. Instances of portfolio integration during earlier periods were evident in NSW and Victoria prior to federation; in NSW, Victoria and SA in the period following federation; and in the third period, Queensland, SA, Tasmania and WA. WA had the least number of mixed portfolios, only during the second and third periods (1901-late 1960s). Full integration at the portfolio level at the state level was evident in the ACT under the Housing and Urban Services portfolio where the responsible minister looked after agriculture, water resources and public utilities, including energy and water services and in Tasmania, under the Primary Industries, Water and Energy portfolios.

Partially integrated two-sector portfolios were more common than three-sector portfolios with some portfolios representing joint activities, such as irrigation and hydroelectricity. At the Commonwealth level and in most states, there were a combination of mixed-sector portfolios across the periods. In NSW and Queensland, however, most mixed portfolios either combined energy and water or water and food. There was no pattern to suggest a certain period was associated with one type of mixed portfolio. While energy and water portfolios were common across the states, each period saw a variation in mixed portfolios. Table 7.5 lists the mixed (multiple sector) portfolios in each jurisdiction per period.

Table 7.4: Mixed portfolios created

Sector	Portfolio	Year introduced	Jurisdiction	Party
Energy-Water	Mines and Water Supply	1880	Victoria	Conservative
	Public Works and Mines	1888	Queensland	Ministerialists
	Mines and Water Supply	1914	WA	ALP
	Hydro-Electric Department, Hydro-Electric Commission	1928	Tasmania	Nationalist
	Interior	1932	Commonwealth	United Australia
	National Development, National Development and Energy	1966	Commonwealth	Liberal
	National Resources	1975	Commonwealth	Liberal
	Urban Services	1991	ACT	ALP
	Power and Water	1995	NT	Country Liberal
	Essential Services	1998	NT	Country Liberal
	Energy and Utilities, Energy and Water Utilities	2003	NSW	ALP
	Natural Resources, Mines and Energy; Natural Resources, Mines and Water	2004	Queensland	ALP
	Climate Change and Water	2007	Commonwealth	ALP
	Climate Change, Energy Efficiency and Water	2010	Commonwealth	ALP
	Energy and Water Supply	2012	Queensland	Liberal National
	Natural Resources and Mines	2012	Queensland	Liberal National
	Energy, Biofuels and Water Supply	2015	Queensland	ALP
	Renewables and Essential Services	2017	NT	ALP
Energy-Food	Mines and Agriculture	1883	Victoria	Conservative
	External Affairs (Prime Ministers)	1937	Commonwealth	United Australia
	Mines and Fisheries	1953	WA	ALP
	Agriculture and Electricity	1962	WA	Liberal
	Primary Industry, Fisheries and Energy	1992	Tasmania	Liberal
	Agriculture and Resources	1996	Victoria	Liberal
	Primary Industries and Resources	2000	SA	Liberal
	Primary Industry, Fisheries and Resources	2008	NT	ALP
	Industry; Industry and Science; Industry, Innovation and Science	2013	Commonwealth	Liberal

Sector	Portfolio	Year introduced	Jurisdiction	Party
Water-Food	Public Works, Agriculture and Water Supply	1881	Victoria	Ministerialists
	Agriculture and Irrigation, Irrigation	1912	SA	Liberal
	Primary Industry	1989	Queensland	ALP
	Agriculture and Water Resources	2015	Commonwealth	Liberal
	Environment, Land and Planning	1991	ACT	ALP
	Primary Industries, Natural Resources and Regional Development	1997	SA	Liberal
	Primary Industries and Water	2004	Tasmania	ALP
Energy-Water-Food	Primary Industries, Water and Energy	1987	Commonwealth	ALP
	Housing and Urban Services, Finance and Urban Services	1989	ACT	ALP
	Regulatory Services	2016	ACT	ALP

Source: Author's compilation from data sources listed in Appendix D

Table 7.5: Mixed portfolios in each jurisdiction by period

	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 4	PERIOD 5
COM		*ENERGY-WATER:* Interior *ENERGY-FOOD:* External Affairs	*ENERGY-WATER:* Interior; National Development; Works *ENERGY-FOOD:* External Affairs; Prime Minister	*ENERGY-WATER:* National Development; National Development & Energy; National Resources; Resources & Energy; Trade & Resources *WATER-FOOD:* Agriculture, Fisheries & Forestry ***ENERGY-WATER-FOOD:*** Primary Industries & Energy	*ENERGY-FOOD:* Industry; Industry & Science; Industry, Innovation & Science *ENERGY-WATER:* Climate Change & Water; Climate Change, Energy Efficiency & Water *WATER-FOOD:* Agriculture, Fisheries & Forestry; Agriculture & Water Resources
NSW	*ENERGY-FOOD:* Mines & Agriculture	*ENERGY-WATER:* Local Government; Public Works *ENERGY-FOOD:* Mines & Agriculture	*ENERGY-WATER:* Local Government; Public Works	*ENERGY-WATER:* Local Government; Public Works	*ENERGY-WATER:* Energy & Utilities; Public Works
VIC	*ENERGY-FOOD:* Mines & Agriculture ENERGY-WATER: Mines & Water Supply *WATER-FOOD:* Public Works, Agriculture & Water Supply	*ENERGY-WATER:* Mines; Mines & Water Supply; Public Works	*ENERGY-WATER:* Mines; Public Works	*ENERGY-FOOD:* Agriculture & Resources	*ENERGY-WATER:* Environment & Climate Change
QLD	*ENERGY-WATER:* Public Works & Mines	*ENERGY-WATER:* Public Works	*ENERGY-WATER:* Local Government & Conservation:	*ENERGY-WATER:* Local Government & Electricity	*ENERGY-WATER:* Energy & Water Supply; Energy &

	WATER-FOOD: Public Lands	Local Government & Electricity: Public Works *WATER-FOOD:* Public Lands & Irrigation	*WATER-FOOD:* Primary Industries; Primary Industries, Fisheries & Forestry	Water Utilities; Energy, Biofuels & Water Supply: Natural Resources: Natural Resources & Mines: Natural Resources, Mines & Energy: Natural Resources, Mines & Water
SA	*ENERGY-WATER:* Public Works *WATER-FOOD:* Agriculture & Irrigation; Irrigation; Public Works	*WATER-FOOD:* Irrigation; Lands	*ENERGY-FOOD:* Primary Industries & Resources *WATER-FOOD:* Irrigation; Primary Industries, Natural Resources & Regional Development	*ENERGY-FOOD:* Primary Industries & Resources
TAS	*ENERGY-WATER:* Hydro-Electricity-related matters	*ENERGY-WATER:* Hydro-Electricity-related matters *ENERGY-WATER-*FOOD: Lands & Works	*ENERGY-FOOD:* Primary Industry, Fisheries & Energy *ENERGY-WATER:* Hydro-Electricity-related matters; Public Works & Water Supplies; Works	*WATER-FOOD:* Primary Industries & Water ***ENERGY-WATER-FOOD:*** Primary Industries, Water & Energy
WA	*ENERGY-FOOD:* Mines & Agriculture *ENERGY-WATER:* Mines & Water Supply *WATER-FOOD:* Goldfields & Agriculture Water Supplies	*ENERGY-FOOD:* Agriculture & Electricity; Mines & Fisheries		
NT			*ENERGY-WATER:* Essential Services; Power & Water	*ENERGY-FOOD:* Primary Industry, Fisheries & Resources *ENERGY-WATER:* Essential Services: Renewables & Essential Services *WATER-FOOD:* Environment, Land & Planning
ACT			*ENERGY-WATER:* Urban Services *WATER-FOOD:* Environment, Land & Planning ***ENERGY-WATER-FOOD:*** Finance & Urban Services; Housing & Urban Services	*ENERGY-WATER:* Environment & Climate Change; Environment & Sustainable Development; Environment, Water & Climate Change; Planning; Urban Services *WATER-FOOD:* Environment, Land & Planning ***ENERGY-WATER-FOOD:*** Regulatory Services

Source: Author's compilation from analysis derived from data sources listed in Appendix D

7.1.4 Portfolio creation by different governments

The creation of portfolios is at the discretion of the government in power. Portfolios reflect the government agenda and political priorities. The analysis shows that both Labor and non-Labor governments were responsible for the creation of EWF portfolios. However, many of the first EWF-related portfolios were created by non-party governments in the pre-Federation period. As seen in Table 7.2, non-Labor governments were responsible for creating the majority of EWF-related portfolios during the period, indicating that such matters were put on the government agenda first by these government parties.

While most portfolios were similar, some differences across parties can be observed, for example, climate change portfolios were likely during Labor governments, seen at the Commonwealth level in NSW, Victoria, SA and the ACT. In Victoria, the difference between Labor and Liberal portfolios was that Labor portfolios at times combined energy and water with environment portfolios.

As in seen Table 7.4, in terms of mixed-sector portfolios, non-Labor governments were generally responsible for the creation of more mixed portfolios than Labor governments. However, the creation of mixed portfolios by parties varied according to state. For example, as seen in Table 7.2, in the Commonwealth, Victoria and SA, mixed portfolios were first created by mostly non-Labor parties while in Queensland and ACT, mixed portfolios were first created by Labor parties. From 1880s to the present, however, Labor government ministries have included more mixed portfolios than non-Labor governments.

7.2 Ministerial responsibilities

The analysis of ministerial responsibilities concerns the allocation of portfolios to ministers. Integration of EWF at the ministerial level occurred when either mixed portfolios (combining at least two areas) or when multiple portfolios were allocated to an individual minister. When single portfolios were allocated to individual ministers, this indicated a separation of decision-making and hence siloedness. This also indicated the possibility that the only platform where EWF matters could be discussed together was at the cabinet level alongside ministers responsible for other portfolios. In this case, joint decision and policy making is subject to conflict and competition.

Table 7.6 shows the first ministerial designations introduced in each state and by which political party. The table shows that Victoria introduced most of the first EWF ministerial designations. SA was the first state to introduce a minister with cross-sectoral EWF responsibilities, the first by a Liberal government. In all jurisdictions, aside from WA and ACT, non-Labor parties such as

Liberal, Conservative or Nationalist parties were responsible for introducing the majority of ministerial titles/designations.

There were a multitude of ministerial designations for EWF and for combining EWF, seen across all jurisdictions. Ministerial designations and titles were, like portfolios, often shared between the different governments in power, showing that changes of government did not necessarily result in changes to ministerial titles and instead succeeding governments had kept ministerial designations from previous governments.

The ministerial titles selected were those which explicitly reflected EWF matters. Ministerial titles such as those for land and works and other works-related portfolios were created in the early periods during smaller ministries, however, these were also considered to reflect cross-sectoral responsibilities such as those related to land use, mining, agriculture and possibly energy and water systems.

Table 7.7 shows the count of different mixed ministerial titles combining either: energy and water; energy and food, water and food and EWF. The table shows that the majority of mixed ministerial titles combined energy and water portfolios at the Commonwealth level, NSW, Victoria, Queensland, Tasmania, NT and ACT. Both Tasmania and the ACT had an equal number of mixed ministerial titles combining EWF responsibilities. The majority of mixed ministerial titles in SA combined water and food portfolios while the majority of mixed ministerial titles in WA combined energy and food.

The majority of mixed ministerial titles were during non-Labor governments in the Commonwealth, NSW, Victoria, SA, Tasmania and the NT, and during Labor governments in Queensland, WA and ACT. This reflects the differences between states with respect to their governments.

The full integration of EWF at the ministerial level was seen at the Commonwealth level, when the Minister for Primary Industries and Energy had responsibility over all EWF-related matters and at the state level, with several instances of full integration at the ministerial level in all states except for Queensland and WA. In Victoria, it is assumed that full integration was evident with the Minister for Agriculture also the Minister of Mines, who was also responsible for groundwater, thus representing the three sectors. As discussed, most instances of integration were between two of the three areas, reflecting only partial integration.

Table 7.6: Single and mixed sector EWF ministerial titles first introduced

JURISDICTION		SINGLE SECTOR MINISTERIAL TITLES			MIXED SECTOR MINISTERIAL TITLES			
	Self-government	**Energy (Mining and non-Mining)**	**Water**	**Food (Agriculture)**	**Energy-Water**	**Energy-Food**	**Water-Food**	**Energy-Water-Food**
COM	1901	1948 Min. Shipping and Fuel[a] (ALP)	2007 Min. Environment and Water Resources[b] (LIB)	1942 Min. Commerce & Agriculture[c] (ALP)	1932 Min. the Interior (UAP)	1934 Prime Minister and Min. External Affairs (NAT)	1998 Min. Agriculture, Fisheries & Forestry (LIB)	1998 Min. Primary Industries & Energy (ALP)
NSW	1856	1874 Sec. Mines (SUP) 1920 Min. Local Government (ALP) 1972 Min. Power (LIB)	1885 Min. Public Works (SUP) 1944 Min. Conservation[d] (ALP)	1908 Min. Agriculture (LIB)	1920 Min. Local Government (ALP)	1890 Secretary Mines; Min. Agriculture (FT)	1962 Min. Agriculture; Min. Conservation (ALP)	2005 Min. Natural Resources, Min. Primary Industries, Min. Mineral Resources (ALP)
VIC	1855	1866 Min. Mines (SUP)	1866 Min. Public Works (SUP) 1880 Min. Mines and Water Supply (MIN)	1871 Min. Lands & Agriculture (SUP)	1880 Min. Mines and Water Supply (MIN)	1883 Min. Mines and Agriculture (CON)	1881 Min. Public Works, Agriculture & Water Supply (MIN)	1935 Min. Agriculture and Min. Mines (UCP)
QLD	1859	1874 Sec. Public Works & Mines (MIN)	1932 Sec. Public Lands (ALP) 1963 Min. Local Government and Conservation (COU)	1893 Sec. Public Lands & Agriculture (MIN)	1963 Min. Local Government and Conservation (COU)	1982 Min. Mines & Energy, Min. Primary Industries (COU)	1950 Sec. Public Lands & Irrigation (ALP)	-
SA	1856	1912 Commissioner for Public Works; Min. Mines (LIB)	1856 Commissioner for Public Works (MIN)	1875 Min. Agriculture and Education (MIN)	1912 Commissioner for Public Works; Min. Mines (LIB)	1919 Min. Mines, Min. Agriculture (LIB)	1905 Commissioner for Public Works, Min. Agriculture (CON) 1912 Min. Agriculture and Irrigation (LIB)	1920 Min. Agriculture, Min. Irrigation, Min. Mines (LIB)
TAS	1856	1904 Min. Mines[e] (ALP)	1928 Minister administering the Hydro-Electric	1903 Min. Agriculture[e] (SUP)	1928 Minister administering the	1984 Min. Mines, Min. Sea Fisheries (LIB)	1979 Min. Primary Industry, Min. Water	1993 Min. Environment and

JURISDICTION		SINGLE SECTOR MINISTERIAL TITLES			MIXED SECTOR MINISTERIAL TITLES			
	Self-government	**Energy (Mining and non-Mining)**	**Water**	**Food (Agriculture)**	**Energy-Water**	**Energy-Food**	**Water-Food**	**Energy-Water-Food**
			Department (NAT)		Hydro-Electric Department (NAT)	1992 Min. Primary Industry, Fisheries and Energy e (LIB)	Resources, Min. the Environment (ALP)	Lands Management (LIB) 2006 Min. Primary Industries & Water, Min. Energy (ALP)
WA	1890	1893 Min. Mines and Education (FOR) 1959 Min. Electricity (LCL)	1913 Min. Works and Water Supply; Min. Sewerage and Drainage (ALP)	1905 Min. Agriculture (ALP)	1914 Min. Mines and Water Supply, Min. Sewerage and Drainage (ALP)	1924 Min. Mines and Agriculture (ALP)	1927 Min. Goldfields and Agriculture Water Supplies (ALP)	-
NT	1978	1974 Executive Member for Resource Development (CL)	1982 Min. Primary Production and Conservation (CL)	1974 Executive Member for Primary Industry and the NT Public Service (CL)	1988 Min. Mines and Energy, Min. Conservation (CL)	1983 Min. Mines and Energy, Min. Primary Production (CL)	1982 Min. Primary Production and Conservation (CL)	2002 Min. Essential Services, Min. Primary Industry and Fisheries (ALP)
ACT	1988				1991 Min. Urban Services (ALP)		1991 Min. Environment, Land and Planning (ALP)	1989 Min. Housing and Urban Services (ALP)

Source: Author's compilation from data sources listed in Appendix D

Notes: a. Prime Minister and Minister for External Affairs (NAT) dealt with energy in 1923 b. Minister for Home Affairs (ALP) had water responsibilities in 1910, c. Minister for Trade and customs responsible for administering food-related legislation, d, Minister for Conservation considered to be responsible for water as seen in Hughes (1984), e. 1856 Sec. Lands & Works, possibly responsible for Mining and Agriculture (SUP)

Table 7.7: Number of mixed ministerial titles

	EW			EF			WF			EWF		
	Total *	Non-ALP	ALP	**Total ***	Non-ALP	ALP	**Total ***	Non-ALP	ALP	**Total ***	Non-ALP	ALP
COM	**11**	9	6	**5**	7	2	**2**	2		**1**	1	1
NSW	**19**	16	12	**6**	5	3	**5**	3	2	**1**		1
VIC	**14**	22	6	**3**	5	1	**5**	6	1			
QLD	**13**	7	9	**1**	1		**5**	2	4			
SA	**9**	5	4	**4**	3	1	**13**	13	5	**2**	1	1
TAS	**7**	4	4	**4**	3	1	**5**	3	2	**7**	6	1
WA	**3**		3	**6**	3	3	**4**	1	3			
NT	**6**	5	2	**5**	2	3	**4**	4		**3**	1	3
ACT	**7**	1	7				**2**	1	2	**7**	2	7

* Non-ALP and ALP parties share ministerial titles which explains why summing portfolios of both ALP and non-ALP will not equal to total

Source: Author's compilation from analysis derived from data sources listed in Appendix D

Integration at the ministerial level indicates the possible consideration of linkages by ministers who are responsible for multiple sectors. With multiple-sector-related responsibilities, ministers may require the creation or merging of relevant departments whose coordinated work would better inform decisions to be made by the minister. For example, the need to merge the separate departments of agriculture and water to inform the minister who is responsible for agriculture and water.

However, it is also important to note that ministerial responsibilities may not reflect decisions in favour of integration, such that integration may not be a deliberate decision by government. Much of the allocation of ministerial responsibilities is also largely politically driven and attributed to political decisions or strategies or party policies unrelated to the need to jointly govern sectors. Often distinct areas, for example, Immigration and Energy, have been grouped together as part of a minister's responsibility, which means that allocating multiple portfolios might not always be a sign of integration. Nonetheless, because of the linkages between sectors, it was assumed that a minister responsible for either energy-water, energy-food, water-food or EWF matters, even if these were in separate portfolios, would consider the linkages and potential policy impacts of policymaking in one area on another area.

Another point is that the level of integration in terms of ministers responsible for multiple portfolios can also be linked to the number of ministers that comprise cabinet ministries (Moon & Sharman 2003). The smaller the ministry, the greater the likelihood that ministers would take

on multiple portfolios rather than those where there are numerous ministers where individual portfolios can be allocated to each minister.

7.3 Organisational responsibilities

The extent of integration here is reflected in the extent to which organisations had roles and responsibilities across all three sectors, whether they were exclusive of each other and where work was carried out by separate organisations following sector-specific objectives.

Government departments were an important group of organisations given their roles in advising policy, implementing policy and carrying out work of their respective portfolios. Table 7.8 shows the establishment of government departments in each state and the political party in government. Their responsibilities indicated the extent to which government departments may implement policy in isolation. In general, the importance of government departments was based on the idea that their creation 'indicates an institutionalisation of the government's commitment to action' (Rose 1990, p. 253). Government departments created for EWF further signal the governments' commitment to addressing EWF matters. Compared with the level of integration at the ministerial level, there were few instances of departments with responsibilities across all sectors.

At the Commonwealth level, there was only one department with combined EWF responsibilities, the Department of Primary Industries and Energy, corresponding to the minister and the portfolio. At the state level, a number of departments had combined EWF responsibilities. Such departments included those responsible for broader areas such as industry, economic development or the environment. In WA, only the Department of Public Works, established by the Labor Party, was considered to have cross-sectoral responsibilities. Similar to portfolios and ministerial titles, Victoria was often the first state to establish EWF departments. The Liberal party was responsible for the establishment of most government departments responsible for EWF matters in Victoria.

Other organisations aside from government departments also had cross-sectoral responsibilities. These included independent regulators with responsibilities for regulating both energy and water prices as well as special commissions for irrigation and hydroelectricity (Hydro-Electric Commission of Tasmania) responsible for both water-food and energy-water matters. Prior to the 1990s, the provision of energy and water were both the responsibility of separate large statutory authorities who had separate responsibilities over provision and service, some of which had regulating and policy advisory roles, influencing sector-specific policy and regulation.

Table 7.8: Single and mixed sector EWF government departments first established

JURISDICTION		SINGLE SECTOR DEPARTMENTS			MIXED SECTOR DEPARTMENTS			
	Self-government	**Energy (Mining & non Mining)**	**Water**	**Food (Agriculture)**	**Energy-Water**	**Energy-Food**	**Water-Food**	**Energy-Water-Food**
COM	1901	1923 Dept. Home & Territories, Dept. Prime Minister & Dept. External Affairs (NAT) 1950 Dept. Fuel, Shipping & Transport (LIB)	1912 Dept. Home Affairs (ALP) 1972 Dept. Environment & Conservation (ALP) 2007 Dept. Environment & Water Resources (LIB)	1912 Dept. Trade & Customs, Dept. Prime Minister (ALP) 1943 Dept. Commerce & Agriculture (ALP)	1932 Dept. the Interior (UAP) 1950 Dept. of National Development (LIB)	1934 Dept. Prime Minister & Dept. External Affairs (UAP)	1998 Dept. of Agriculture, Fisheries & Forestry (LIB)	1988 Dept. of Primary Industries & Energy (ALP)
NSW	1856	1873 Dept. Mines (MIN) 1987 Dept. Energy (ALP)	1987 Dept. Water Resources (ALP)	1908 Dept. Agriculture (LIB)	1999 Ministry of Energy & Utilities (ALP) 2007 Dept. Water & Energy (ALP)	1891 Dept. Mines & Agriculture (PROT) 2004 Dept. Primary Industries (ALP)	1909 Dept. Public Works (Irrigation & Drainage Branch) (LIB) 2017 Dept. Primary Industries (LIB)	1980 Department of Planning (ALP)
VIC	1855	1860 Dept. Mines (SUP) 1965 Ministry of Fuel & Power (LIB)	1860 Dept. Mines (SUP) 1977 Ministry of Water Resources & Water Supply (LIB)	1872 Dept. Agriculture (SUP)	1860 Dept. Mines (SUP) 1895 Dept. Mines & Water (LIB) 1994 Essential Services Commission (LIB)	1995 Dept. Agriculture, Energy & Minerals (LIB)	2013 Dept. Environment & Primary Industries (LIB)	1992 Dept. Conservation & Natural Resources (LIB)
QLD	1859	1891 Dept. Mines (MIN) 1989 Dept. Resource Industries (NAT)	1881 Dept. Water Supply (MIN)	1887 Dept. Agriculture (MIN)	2001 Dept. Natural Resources & Mines (ALP)	-	1932 Lands Department (Irrigation & Water Supply Sub-Department) (ALP)	2000 Dept. Natural Resources (ALP)
SA	1856	1894 Dept. Mines (LIB)	1867 Dept. the Engineer in Chief & Engineer of	1883 Dept. Agriculture (MIN)	2014 Dept. State Development (ALP)		1908 Dept. Agriculture (ALP)	1997 Dept. Primary Industries &

JURISDICTION		SINGLE SECTOR DEPARTMENTS			MIXED SECTOR DEPARTMENTS			
	Self-government	**Energy (Mining & non Mining)**	**Water**	**Food (Agriculture)**	**Energy-Water**	**Energy-Food**	**Water-Food**	**Energy-Water-Food**
		1977 Dept. Mines & Energy (ALP)	Waterworks (SUP)					Resources (PIRSA I) (LIB)
TAS	1856	1895 Dept. Mines (MIN) 1980 Office of the M. Energy (ALP)	1978 Office of the Minster for Water Resources (ALP)	1899 Dept. Agriculture (MIN)	1914 Hydro-Electric Department (ALP)	-	1996 Dept. Primary Industry & Fisheries (LIB)	1992 Dept. Primary Industry, Fisheries & Energy (LIB)
WA	1890	1894 Dept. Mines (FOR)	1901 Dept. Public Works (MIN) 1910 Water Supply, Sewerage & Drainage Department (MIN)	1898 Dept. Agriculture (MIN)	-	-	-	1939 Dept. Public Works (ALP)
NT	1978	1878 Dept. Mines & Energy (CLIB)	1987 Power & Water Authority (CLIB) 2005 Dept. Natural Resources, Environment & the Arts (ALP)	2005 Dept. Primary Industry, Fisheries & Mines (ALP)	1987 Power & Water Authority (CLIB)	2009 Dept. Regional Development, Primary Industry & Resources (ALP)	2007 Dept. Health (ALP)	-
ACT	1988				2000 Dept. Urban Services (LIB)			2016 Environment, Planning & Sustainable Development Directorate (ALP)

Source: Author's compilation from data sources listed in Appendix D

Intergovernmental councils bringing together Commonwealth and state representatives, as mentioned, were considered relevant organisations, particularly with their functions to advise policy. Some councils covered cross-sectoral matters. These included the National Health and Medical Research Council dealing with water and food-related human health concerns, the Snowy Mountains Council covering both irrigation and hydroelectricity-related matters and other councils such as the Murray-Darling Basin Ministerial Council and the Agriculture and Resource Management Council of Australia and New Zealand, dealing with cross-sectoral water and agriculture matters.

Summary

The above discussion emphasises the importance of portfolios as they reflect government agendas and indicate how a government frames its responsibilities to EWF matters. EWF portfolios have evolved to reflect changes in priorities and were created by different political parties.

At the Commonwealth level, given its limited constitutional powers over EWF, for many years EWF matters were subsumed under broader portfolios and while the first energy- and food-sector-focussed portfolios were created in 1940s and 1950s, it was only in 2007 when the first water-sector-focussed portfolio was created.

At the state level, the creation of EWF-sector-focussed portfolios varied. Mining and agricultural portfolios were created during the earlier periods in all states prior to federation, indicating such matters were originally state concerns. Water portfolios were created first in Victoria pre-federation in the late 1880s and last in NSW after 1970. Non-mining energy-focussed portfolios were created in later periods.

The analysis sought to trace the integration of EWF across the policy and decision-making chain, from portfolio representation to ministerial and organisational components (mostly government departments).

The analysis of mixed portfolios, ministerial responsibilities and organisations showed there were several instances to indicate cross-sectoral responsibilities over EWF, although very few instances of full EWF integration. While partial integration between two areas was evident, in some cases, it varied across portfolios, ministerial and departmental levels.

The integration of EWF was mostly evident at the ministerial level, with ministers often having responsibilities across EWF domains. This shows that while portfolios appeared to separate EWF matters, they were often jointly handled by individual ministers, as seen particularly in Victoria.

7.4 Relationships between portfolios, ministers and organisations

This section examines the relationship between portfolio representation, ministerial responsibilities (allocation of portfolios to ministers) and government departments to identify the extent to which EWF responsibilities have been integrated. This relationship reflects the decision-making, policy-making and implementation chain (or structure) and includes Level 2 institutions represented by government portfolio arrangements and ministerial responsibilities and Level 3 institutions represented by organisations.

7.4.1 Linkages between portfolios, ministers and government departments

An important consideration when identifying the extent of integration (nexus) of EWF is that portfolios, ministers and government departments are interrelated. Portfolios represent certain areas of the governments' responsibilities and are allocated to ministers as their designated responsibilities. Government departments are responsible to the respective minister who holds the portfolio to which the responsibilities of the government department correspond. Government departments, however, may be responsible to more than one minister.

The analysis of EWF integration in portfolios examined whether EWF responsibilities were combined into single portfolios, (e.g. Mines and Agriculture portfolio) or separated into multiple portfolios. Portfolios included those with specific titles (e.g. Water Supply) and non-specific titles (e.g. National Development) where EWF matters were treated along with other matters.

The existence of single-sector portfolios (as seen above), however, did not indicate a complete separation of EWF. Often, multiple portfolios were allocated to an individual minister, combining otherwise separate portfolio responsibilities (for example, allocating both energy and water portfolios to one minister). This reflects integration at the ministerial level, as opposed to the portfolio level, given that the minister was responsible for more than one sector. Similarly, when government departments represented a single-sector portfolio, integration was still possible if the minister responsible was also responsible for other sector portfolios.

However, where ministers had separate responsibilities, the integration of EWF was also possible at the government department level, for example, where separate ministers were supported by one government department which was responsible for EWF. The relationship between portfolio, ministerial and department responsibilities suggests that in order to identify complete separation, integration needed to be considered at all levels (portfolios, ministerial and organisational responsibilities). The separation of EWF at one level may be compensated by integration at other

levels. The role of councils and committees in the facilitation of integrated decision and policy-making between otherwise separate ministers with separate portfolios is also important.

Table 7.9 summarises the findings where evidence of integration within portfolios, ministers and organisations is identified in each state over the five time periods. The extent of integration, that is, partial integration (energy-water, energy-food, water-food) and full integration (energy-water-food) is examined and is measured by the existence of a mixed portfolio, a cross-sectoral minister or a cross-sectoral department and duration, that is, how long (in years) has a mixed portfolio been part of the government's portfolios and how long has a minister or a government department with multiple sector responsibilities served/existed. Each square indicates the number of years. The red squares indicate the times when no mixed portfolio, cross-sectoral minister or cross-sectoral department served/existed. The light green squares indicate when either cross-sectoral ministers or cross-sectoral departments served/existed for less than half the period, and the dark green squares indicate when cross-sectoral ministers or cross-sectoral departments served/existed for more than half of the period.

Table 7.9 shows that over time, integration has improved, characterised by examples of full integration and partial integration. The current situation, however, shows little integration, with few instances of integration in all states and in particular, few instances of full EWF integration, only in the ACT and NSW. The state with the most integration was Victoria while WA was the state with the least evidence of integration, hence the most siloed state. Tasmania, however, was the state with the most instances of full EWF integration.

As seen, the level of integration, however, varied across the five periods. While integration has mostly been reflected at the ministerial level, there has been a greater number of instances of departments with cross-sectoral responsibilities. Consistency between integration across portfolios, ministers and departments was seen at the Commonwealth level (where integration at portfolio levels was matched at the ministerial level and the departmental level). At the state level, integration between portfolios, ministers and departments was inconsistent, indicating asymmetries of EWF responsibilities.

The following discussion provides an overview of EWF integration in portfolio, ministerial and organisational responsibilities at the Commonwealth and state level.[15]

[15] Further details regarding portfolios, ministers and organisations of the analysis are provided in Appendices E, F and G.

Table 7.9: Portfolio, ministerial and organisational integration of EWF

		PERIOD 1			PERIOD 2			PERIOD 3			PERIOD 4			PERIOD 5			CURRENT		
STATE		PORT	MIN	ORG	PORT	MIN	ORG	PORT	MIN	ORG	PORT	MIN	ORG	PORT	MIN	ORG	PORT	MIN	ORG
COM	E W				7	7	7	25	25	25	17	17	17	3	3	7	0	0	0
	E F				5	5	5	10	10	8	0	0	0	3	3	3	0	0	0
	W F				0	0	0	0	0	0	2	2	2	11	11	11	1	1	1
	E W F				0	0	0	0	0	0	11	11	10	0	0	0	0	0	0
NSW	E W	0	0	0	19	19	19	31	31	31	30	30	26	2	7	11	0	1	0
	E F	10	11	10	6	6	7	0	1	0	0	7	0	0	5	5	0	0	0
	W F	0	0	0	2	2	2	0	3	0	0	0	0	0	5	2	0	1	1
	E W F	0	0	0	0	0	0	0	0	0	0	0	15	0	2	10	0	0	1
VIC	E W	2	9	6	21	21	38	31	24	31	0	21	20	2	10	0	0	0	0
	E F	3	3	0	0	0	0	0	0	0	3	3	2	0	0	15	0	0	1
	W F	2	3	0	0	12	0	0	3	0	0	0	0	0	4	2	0	0	0
	E W F	0	0	0	0	4	0	0	12	0	0	0	8	0	0	2	0	0	0
QLD	E W	0	0	0	0	0	0	2	7	0	5	5	0	16	16	15	1	1	1
	E F	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
	W F	0	0	0	7	7	7	15	15	7	7	7	7	0	0	0	0	0	0
	E W F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
SA	E W	0	0	0	0	6	0	0	0	0	0	0	0	0	2	0	0	0	1
	E F	0	0	0	0	1	0	0	0	0	0	2	3	1	1	19	0	0	1
	W F	0	0	0	20	22	31	31	31	31	14	14	22	0	0	0	0	0	0
	E W F	0	0	0	0	3	0	0	0	0	0	0	0	0	3	12	0	0	0
TAS	E W	0	0	0	4	10	25	5	5	31	8	8	10	6	6	0	0	0	0
	E F	0	0	0	0	1	0	0	0	0	1	6	0	0	0	0	0	0	0
	W F	0	0	0	0	0	0	0	0	0	0	7	4	0	0	19	1	1	1
	E W F	0	0	0	0	4	0	0	4	0	5	5	4	1	8	0	0	0	0
WA	E W	0	0	0	2	2	0	0	0	0	0	0	0	0	1	0	0	0	0
	E F	0	0	0	3	3	0	12	13	0	1	1	0	0	0	0	0	0	0
	W F	0	0	0	3	3	0	0	0	31	0	4	0	0	2	0	0	1	0
	E W F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NT	E W										3	5	1	13	12	0	1	1	0
	E F										0	2	0	6	13	8	1	1	1
	W F										1	6	0	0	1	8	0	0	0
	E W F										0	0	0	0	5	0	0	0	0
ACT	E W										9	9		14	14	16	1	1	0
	E F										0	0		0	0	0	0	0	0
	W F										7	7		3	3	0	0	0	0
	E W F										2	2		7	7	3	1	1	1

Source: Author's compilation from analysis derived from data sources listed in Appendix D

Note: PORT – Portfolio Representation, MIN – Ministerial Responsibilities, ORG – Organisations ■ - no integration during period, ■ - integration evident ≤ half of period, ■ - integration evident ≥ half of period (majority), ■ - no information . Numbers inside boxes indicate the number of years during the period in which there was a cross-sectoral portfolio, minister or organisation.

Commonwealth

At the Commonwealth level, the extent of EWF integration depended on how portfolios were created and whether EWF matters were combined into single portfolios. This was because ministers were allocated single portfolios and each portfolio had a corresponding government department.

The level of integration of EWF was consistent from portfolios to ministers through to government departments. Ministers with cross-sectoral responsibilities were almost always supported by a corresponding cross-sectoral government department. Integration was seen mostly between energy and water and the only instance of fully integrated EWF responsibilities was seen in the Primary Industries and Energy portfolio with the corresponding minister and department, the Department for Primary Industries and Energy (1988 to 1998). This Department operated during the Hawke and Keating Labor government until it was reorganised in 1998 under the Howard Liberal government. The Department was responsible for administering a number of energy-related, agriculture-related and water-related Acts including the Murray-Darling Basin Acts.

The analysis found that the number of years served by a minister with cross-sectoral responsibilities (at least partially integrated) accounted for 69% of the five periods since 1901, which is approximately 82 years. Most of these years were served by ministers responsible for both energy and water. The number of years served by a government department with cross-sectoral responsibilities (at least partially integrated) accounted for 70% of the five periods, which is approximately 83 years. These years were mostly served by a government department responsible for both energy and water. Integration between energy and water was most prominent at the Commonwealth level during the third and fourth periods. In the most recent period from 2000, integration between water and food sectors has been prominent.

New South Wales

In NSW, integration was most evident between two sectors rather than all three and in particular in combining energy and water. The integration of ministerial responsibilities and department responsibilities was seen in all periods, although with a greater number of organisations with cross-sectoral responsibilities in the last period. The number of years served by ministers and departments with cross-sector responsibilities was similar, potentially indicating that most cross-sectoral ministers had supporting cross-sector departments. However, this was not always the case. During the fourth and fifth periods, there were both instances of cross-sectoral ministers without corresponding departments, as well as cross-sectoral departments that were responsible to multiple ministers. For example, neither the minister responsible for Agriculture and Water Resources (1975-1977) nor the minister responsible for Agriculture, and Land and Water

Conservation (1997-2001) had a corresponding department. Departments for industry towards the end of the period, while responsible for EWF matters, were responsible to multiple ministers.

Only during the fifth period (2000–present) was there full integration at the ministerial level represented by the minister responsible for natural resources, primary industries and mineral resources portfolios during the Iemma Labor government from 2005 to 2008. Full integration at the organisational level was evident later in the period represented by industry and trade departments.

Current arrangements, however, indicate some integration. For example, the Minister for Primary Industries, Minister for Regional Water is responsible for both water and food while the Minister for Resources, Minister for Energy and Utilities is responsible for energy and water. At the organisational level, the Department for Primary Industry has both water and food responsibilities while the Department for Planning and Environment is responsible separately for energy. Current arrangements, however, indicate an overlap in the responsibilities for water which is the responsibility of the two ministers, the first being responsible for regional water and the second being responsible for utilities.

The number of years in which a minister with cross-sectoral responsibilities served accounted for 69% of all periods (112 years). The majority of these years were served by a minister responsible for both energy and water. The number of years served by a government department with cross-sectoral responsibilities (at least partially integrated) accounted for 71%, approximately 115 years. These years were mostly served by a government department responsible for both energy and water. Both ministerial and government department responsibilities highlight the joint governance energy and water.

Victoria

The extent of integration varied across portfolio, ministerial and the organisational levels. In Victoria, integration was most evident at the ministerial level, characterised by ministers who were responsible for multiple portfolios. The combination of portfolios allocated to individual ministers included all combinations of energy and food, energy and water and water and food, but combinations between energy and water were most common. Portfolios were mostly separate, and at the organisational level, integration was limited to the Department of Mines, followed by the Department of Mines and Water Supply, both responsible for mining and groundwater.

Instances of full EWF integration were seen with the Minister for Agriculture and Minister for Mines (responsible for groundwater) during the late 1930s and the mid-1940s and next with the Department of Natural Resources and the Environment in the late 1990s to early 2000s.

Although the number of years served by a cross-sectoral minister and a cross-sectoral department were close (with a gap of seven years), asymmetry did exist between the ministers and departments and their responsibilities. While ministers had cross-sectoral responsibilities, they were not necessarily supported by government departments that had the corresponding cross-sectoral responsibilities. For example, this was seen for ministers responsible for agriculture and water portfolios with no corresponding department. At the same time, cross-sectoral departments during the 1990s were also responsible to separate ministers.

Current arrangements indicate integration between EWF only at the department level, as seen in the Department of Environment, Land, Water and Planning with separate ministers.

The number of years in which a minister with cross-sectoral responsibilities served accounted for 71% across the five periods (115 years). The majority of these years were served by a minister responsible for energy and water. The number of years served by a government department with cross-sectoral responsibilities accounted for 75% (122 years). These years were served by a government department responsible for both energy and water, in particular, the mining departments responsible for both mining and groundwater matters. Similar to NSW, energy and water were governed jointly.

Queensland

EWF at the portfolio, ministerial and organisational level remained mostly disconnected throughout the periods, indicating the separation of EWF. While evidence of full EWF integration was limited to one department (Department of Employment, Economic Development and Innovation), there were several mixed portfolios and several cross-sectoral departments that combined energy and water responsibilities.

Some mismatch however between ministers and departments was evident during the periods. For example, the Department of Employment, Economic Development & Innovation, responsible for EWF simultaneously was responsible to separate ministers. More recently, however, ministers responsible for energy and water (natural resources and mines) have had corresponding government departments (Department Natural Resources and Mines and Department for Energy and Water Supply).

The current arrangements include a mixed portfolio for energy and water, the Natural Resources, Mines and Energy portfolio, with its corresponding government department. Food matters are currently the responsibility of separate ministers and departments.

The number of years in which a minister with cross-sectoral responsibilities served accounted for less than half of the years across all five periods, this being 41% of the period (66 years). The majority of these years were served by ministers responsible for water and food. The number of

years served by a government department with cross-sectoral responsibilities accounted for 28% (44 years) of all periods. These years were served by a government department responsible for both water and food. The most prominent combination of integration was between water and food, which was different to the other states where integration between energy and water was prominent.

South Australia

Integration was evident at the ministerial and department level with a couple of instances of full integration of EWF responsibilities, for example the Minister for Agriculture, Minister for Irrigation, Minister for Mines (1920-1922), Minister for Mines, Minister for Irrigation (1933-1934), Minister for Mineral Resources Development, Minister for Agriculture, Food and Fisheries (2002-2004) and the Department of Primary Industries and Resources (2002-2011). Otherwise, departments were mostly siloed with only a couple of departments with cross-sectoral responsibilities in water and food. Differences between the years served by a cross-sector minister and cross-sector department however also indicated asymmetries where ministers and department did not correspond to each other.

The number of years in which a minister with cross-sectoral responsibilities served accounted for 59% of all periods (85 years). The majority of these years were served by ministers responsible for water and food. The number of years served by a government department with cross-sectoral responsibilities accounted for 74% of all periods (106 years). These years were also predominantly served by a government department responsible for both water and food. Water and food linkages were emphasised.

Tasmania

Like other states, the integration of EWF (partial and full) was mostly at the ministerial level. From the 1970s, there has been to a large extent, full integration between EWF. In 1992, the Department of Primary Industries, Fisheries and Energy had responsibilities across all EWF sectors. From 2006 and 2014, a minister was simultaneously responsible for EWF.

While portfolios have mostly been separate, much of the integration between EWF was seen at the ministerial and department level, although with asymmetries in responsibilities in the years served by ministers and departments. There were several instances where cross-sectoral ministers did not have corresponding departments. For example, the ministers responsible for primary industries, water and energy portfolios from 2006 to 2014 did not have corresponding departments that were also responsible for all sectors.

The number of years in which a minister with cross-sectoral responsibilities served was 56 years accounting for 34% of all periods. The majority of these years were served by ministers

responsible for energy and water. The number of years in which a government with cross-sectoral responsibilities served was 93 years accounting for 57% of all periods. The majority of these years were served by organisations responsible for energy and water, namely the organisations responsible for the state's hydroelectricity developments.

Western Australia

Instances of integration were seen at the portfolio and ministerial level, and there was only one department with cross-sectoral responsibilities. In WA, integration between EWF (partial integration) was very limited. There were very few mixed portfolios (e.g. Mines and Agriculture portfolio and Agriculture and Electricity portfolio), few ministers with cross-sectoral responsibilities (e.g. Minister for Agriculture, Minister for Water Resources) and the majority of departments were responsible for separate EWF matters. There was no minister or department with simultaneous EWF responsibilities.

The years in which a minister with cross-sectoral responsibilities served accounted for less than a quarter of all periods (23%). The majority of these years were served by ministers responsible for energy and food. The number of years served by a government department with cross-sectoral responsibilities accounted for 24% of all periods (31 years). These years were served by a government department responsible for both water and food.

Northern Territory[16]

Most integration was evident at the ministerial level with few ministers with responsibilities across all EWF sectors (e.g. the minister responsible for essential services, primary industry, fisheries and resources, natural resources, environment and heritage). There were some instances of mixed portfolios but such only represented partial integration, linking only two of the three sectors, such as energy and water (Power and Water portfolio), energy and food (Primary Industry, Fisheries and Resources portfolio, and water and food (Primary Production and Conservation portfolio). One example of a department with cross-sectoral responsibilities was the Department of Primary Industry and Resources, being responsible for energy and food matters.

The number of years in which a minister with cross-sectoral responsibilities served accounted for 71% of total years since self-government (32 years). The majority of these years had ministers responsible for both energy and water and energy food at the same time. The number of years served by a government department with cross-sectoral responsibilities accounted for almost a

[16] Information on organisations for the entire period, however, was not available so the complete comparison between ministers and organisations cannot be made.

quarter of all periods (24% or 11 years). As seen, most cross-sectoral responsibilities included those combining energy and food.

Australian Capital Territory

Since self-government was introduced in the ACT, there has been both partial and full EWF integration between portfolios and ministers, particularly in the early years with a single minister responsible for EWF matters simultaneously. These ministers included the Minister for Housing and Urban Services and the Minister for Finance and Urban Services. This may have also been the result of smaller ministries. In 2007, another minister was responsible for EWF as the Minister for Planning and the Minister for Health (2004-2004, 2004-2006). In 2014, both the Minister for the Environment, Minister for Health (2014-2015) and the Minister for Environment and Climate Change and the Minister for Health (2016-2016) (individual ministers) had combined EWF responsibilities.

Energy and water responsibilities were allocated to an individual minister for most of the period until 2016 when energy and water matters were separated, allocated to the Minister for Climate Change and Sustainability (2016-Present) who had energy responsibilities and the Minister for Environment and Heritage (2016-Present) who had water responsibilities. Agriculture has not been a major portfolio in the territory. All food matters were dealt with by the Health Department. Full integration of responsibilities was evident at the portfolio and ministerial level which corresponded to each other. That is, each portfolio had a corresponding minister.

The number of years in which a minister with cross-sectoral responsibilities served accounted for 97% of the period (29 years). For almost the entire period, there was a minister with cross-sectoral responsibilities. The number of years served by a government department with cross-sectoral responsibilities accounted for 63% of the measured period (30 years). As seen, most cross-sectoral departments included those combining energy and water.

7.5 Discussion

7.5.1 Portfolio representation

An analysis of the EWF portfolios of the Commonwealth and state governments over time shows that while EWF matters have mostly been arranged in separate portfolios (framed as separate matters); there is some evidence of portfolios combining EWF matters in each state and at the Commonwealth level. Most mixed portfolios grouped energy and water matters, for example, portfolios for mining and water supply portfolios. Energy and food matters were grouped into portfolios associated with mines or resources and agriculture, and water and food were grouped into portfolios associated with agriculture and water supply or irrigation.

The analysis shows that there were more instances of integrated portfolios during the fourth and fifth period. Portfolios reflecting full EWF integration included the Commonwealths' Primary Industries and Energy portfolio (1987-1998), ACT's early portfolios for Housing and Urban Services and Finance and Urban Services, during the 1990s and Tasmania's Primary Industries, Water and Energy portfolio.

7.5.2 Ministerial responsibilities

The analysis shows integration was largely at the ministerial level compared to integration at the portfolio levels. Although many of the portfolios that were created had separated EWF matters into separate portfolios, there were several instances when an individual minister would be allocated a combination of multiple portfolios. For example, in NSW (1975-1977) two portfolios, the Agriculture portfolio and the Water Resources portfolio were allocated to an individual minister who then played a dual role as Minister for Agriculture and Minister for Water Resources. Although portfolios were separate, decision-making was connected through one minister. Separation existed if one of the portfolios were to be removed from the ministers' responsibilities and transferred elsewhere.

There were a number of ministers with cross-sectoral responsibilities for either energy and water, energy and food, water and food or EWF simultaneously, indicating both partial and full integration of EWF responsibilities. Table 7.10 lists all the ministers with integrated EWF responsibilities.

Ministers with combined EWF responsibilities included the Minister for Primary Industries and Energy (corresponding to the portfolio) at the Commonwealth level; the Minister for Agriculture, Minister for Irrigation, Minister for Mines in SA and a number of ministers responsible for multiple EWF-related portfolios in Tasmania. In Tasmania, various ministers had cross-sectoral responsibilities, being responsible for a combination of agriculture, mines, works and hydroelectricity-related portfolios. In ACT, ministers with combined EWF responsibilities were those corresponding to earlier portfolios such as the Minister of Housing and Urban Services and Minister of Finance and Urban Services during the 1990s.

Table 7.10: Ministers with combined EWF responsibilities

State	Ministers	Years served
COM	Min. Primary Industries & Energy	1987-1998
NSW	Min. Natural Resources, Min. Primary Industries, Min. Mineral Resources	2005-2007
VIC	Min. Agriculture, Min. Mines (responsible for groundwater)	1935-1943 1945-1963
SA	Min. Agriculture, Min. Irrigation, Min. Mines	1920-1922
	Min. Mines, Min. Irrigation	1933-1934
	Min. Mineral Resources Development, Min. Agriculture, Food & Fisheries	2002-2004
TAS	Min. Administering the Hydro-Electric Department, Minister administering the Agricultural Bank	1934-1935
	Min. Administering the Commerce & Industry Division of Dept. Agriculture, Minister administering the Hydro-Electric Commission Act 1944	1947-1958
	Min. Primary Industries & Water, Min. Energy	2006-2008
	Min. Primary Industries, Water & Energy	2008-2009
	Min. Primary Industries, Water & Energy, Min. Energy & Resources	2009-2011
	Min. Primary Industries & Water, Min. Energy & Resources	2011-2014
NT	Min. Essential Services, Min. Primary Industry and Fisheries	2002-2003
	Min. Essential Services, Min. Primary Industry, Fisheries and Resources, Min. Natural Resources, Environment and Heritage	2012-2013
	Min. Essential Services, Min. Land Resource Management, Min. Mines and Energy, Min. Primary Industry and Fisheries	2013-2016
ACT	Min. Housing and Urban Services	1989-1990
	Min. Finance and Urban Services	1990-1991
	Min. Planning, Min. Health	2004-2006
	Min. the Environment, Min. Health	2015-2016
	Min. the Environment and Climate Change, Min. Health	2016-2017
	Min. Regulatory Services	2016-2018

Source: Author's compilation from data sources listed in Appendix D

7.5.3 Organisations

At the organisational level, the analysis looked at whether organisations had combined EWF cross-sectoral responsibilities, that is, whether an organisation carries out work related to either two or more domains, for example, the Department of National Development at the Commonwealth level was responsible for both energy and water-related matters of the nation. A number of government departments had responsibilities across all EWF areas. Table 7.11 lists the departments with their combined EWF responsibilities.

While there were various ministers with cross-sectoral responsibilities, there were fewer organisations with cross-sectoral responsibilities. However, the number of years in which such organisations had served throughout the periods was similar to the number of years served by ministers with cross-sectoral responsibilities, suggesting that departments were much more stable than ministers who were serving for a longer period of time compared with ministers whose ministerial designations frequently changed. This difference is likely to be associated with the ease of creating new ministerial designations or portfolios versus the ease of creating new departments or rearranging the public service.

Table 7.11: Government departments with combined EWF responsibilities

State	Government Departments	Years served
COM	Dept. Primary Industries & Energy	1988-1998
NSW	Dept. Planning	1980-1995
	Dept. Industry & Investment	2009-2011
	Dept. Trade & Investment, Regional Infrastructure & Services	2011-2015
	Dept. Industry, Skills & Regional Development	2015-2017
	Dept. Industry	2017-Present
VIC	Dept. Conservation & Natural Resources	1992-1996
	Dept. Natural Resources & the Environment	1996-2002
SA	Dept. Primary Industries & Resources (PIRSA I)	1997-2011
	Dept. Primary Industries & Regions SA (PIRSA II)	2011- Present
QLD	Dept. Employment, Economic Development & Innovation	2009-2012
ACT	Economic Development Directorate	2018- Present

Source: Author's compilation from data sources listed in Appendix D

The difference in the frequency of the changes in ministerial designations or portfolio allocations compared with the frequency of changes in government departments can contribute to asymmetries between ministers and departments, as seen where ministers with cross-sectoral responsibilities do not have corresponding departments with the same cross-sectoral responsibilities or when multiple departments must report to a single minister.

When multiple departments report to an individual minister, or in other words, a minister is responsible for multiple departments, this means that the minister carries the burden of mediating between the multiple departments to meet their responsibilities. For example, in Tasmania, the one minister responsible for Mines, Agriculture and the Hydro-Electric Department would have needed to coordinate their respective separate departments. Such an arrangement points to the inadequacy of government departments to support cross-sectoral decision making as a result of siloed departments under a single minister.

The problem, however, may not be severe if the minister can demonstrate leadership and is capable of articulating common objectives across all departments so that the work of separate departments is consistent and is done in cooperation with each other. However, if this is not the case and the minister lacks control over the departments, for example through the frequent reallocation of portfolios and changes in ministers, then departments may continue to carry out work in isolation. The separation of EWF departments is further reinforced when the heads of the departments also do not work together.

The reverse is also possible, where integration is seen at the department level but is not reflected at the ministerial level. This occurs where departments with cross-sectoral responsibilities are responsible to several individual ministers. While duties may be carried out in an integrated matter, it is also possible that there is internal fragmentation. To meet the individual ministers' interests, organisations may be divided, forming silos within the organisation, each responsible to their own minister.

Moreover, as the term of a government department can be much longer than the term of a minister, separation and siloedness could reappear should the ministers change or be allocated new portfolios.

Mismatch and asymmetry between ministers and departments weakens the overall degree of integration where government departments (those responsible for advising policy and implementing policy) cannot sufficiently support ministers whose scope of responsibilities is greater than that of the department itself. Asymmetries show that the consideration of EWF inter-linkages or joint EWF planning would have been mostly limited at the ministerial level with ministers carrying the greater burden of managing multiple sectors. When the scope of responsibilities of government departments matches the scope of cross-sectoral ministers,

assuming the work carried out in departments is integrated, this strengthens the integration of EWF responsibilities.

Another important consideration is that fragmentation also exists within the separate EWF areas. This is seen when responsibilities relating to one sector are shared and spread across either portfolios, ministers or departments. For example, energy has often been represented by different and separate portfolios such as mines, resources or energy or electricity. Similarly, responsibilities for water also vary. Groundwater, as seen, was often a part of mining responsibilities rather than being a part of the overall water responsibilities. Food processing and manufacturing matters were also likely to be a part of industry- and manufacturing-based portfolios rather than agricultural portfolios, which were used to reflect the food-related portfolio. Responsibilities across the supply chain may also be separated into different portfolios.

The analysis sought to find instances of integrated EWF responsibilities, in the responsibilities of a minister and departments and with consideration to the duration of these integrated arrangements, through the length of time that certain ministers or departments served. For example, while there have been many instances of ministers with cross-sectoral responsibilities, if their terms were short, it is less likely that cross-sectoral decision-making occurred.

7.6 Conclusions

This chapter focused on assessing the extent of integration between EWF responsibilities in government portfolios, ministerial responsibilities and organisations (government departments) at Commonwealth and state levels and over time. The main points of this assessment are:

- Both partial (energy-water, energy-food, water-food) and full (energy-water-food) integration has been evident over time and has varied especially across jurisdictions. For example, the longest number of years served by a minister and department with cross-sectoral responsibilities was in Victoria while the least number of years served by a minister or department with cross-sectoral responsibilities was in WA. The analysis showed that overall integration has improved over time, however current arrangements appear mostly siloed.
- The relationship between portfolios, ministerial responsibilities and departmental responsibilities is important to understand the overall extent of integration. For example, siloedness at one level, the portfolio level, could be compensated by integration at the ministerial level. Similarly, siloedness at the ministerial level could be compensated by integration at the department level.
- The analysis observed the variation in integration across portfolios, ministerial responsibilities and departments and the extent to which integration is supported throughout the decision

making and implementation chain, for example, whether there were departments with cross-sectoral responsibilities to support ministers with cross-sectoral responsibilities. Asymmetries between ministerial and departmental responsibilities were identified to show that integration is often weakened. Integration between EWF was most evident at the ministerial level, but at times, ministers were not supported by departments with the same cross-sectoral responsibilities.

- While instances of integration were evident across the periods, current arrangements show very little integration of all three EWF areas, suggesting that the current configuration of portfolios, ministerial responsibilities and government departments are inadequate and unable to support nexus-based policymaking. There is scope for further integration between EWF responsibilities that have otherwise been separated from each other. Currently, most integration is seen in the territories, perhaps explained as a result of smaller ministries and fewer ministers who are often responsible for multiple portfolios.

Whether integration at the level discussed in this chapter correlates with the integration of EWF in the subsequent levels (Level 3 and 4) is discussed in the next chapter.

Chapter 8 Policy, Legislation and Pricing

This chapter examines the extent to which institutional settings of policy and legislative frameworks as well as pricing processes and other sector arrangements consider EWF linkages.

This chapter accordingly focuses on Level 3 and Level 4 institutions involving the analysis of EWF policies, rules (legislation) and other mechanisms (mainly pricing mechanisms). These institutions are designed to meet specific (short-term and long-term) government objectives for particular sectors or the broader government agenda. Together, they influence, directly or indirectly, EWF security.

This chapter is divided into four sections, Section 8.1 dealing with policy, Section 8.2 dealing with legislation and Section 8.3 with pricing processes and other sector arrangements. Each section discusses the extent to which policy and legislative frameworks and pricing processes reflect the integration between EWF.[17][18] Section 8.4 concludes the chapter.

Policy and legislation are developed by the government and are implemented and enforced by government and non-government agencies. These policies are shaped by the agendas of the political party of the time and the way governments prioritise and deals with EWF matters. Of particular interest here is determining the correspondence between EWF at the portfolio-ministerial-organisational level and policy-legislation-pricing level.

8.1 Policy

This section reviews EWF policies with the overall objective of examining the extent to which EWF nexus considerations are integrated in EWF policies.

8.1.1 EWF policies: Early developments to 1969

The pre-federation period was a time of early settlement and the development of separate colonies, later self-governing states. EWF were local matters underpinned by broader policy contexts that

[17] Further details of the analysis regarding policy, legislation and pricing are provided in Appendices J, K and L.

[18] The political parties analysed over the periods have been grouped into two: Labor and non-Labor parties. This borrows from classification used in Moon and Sharman (2003). The grouping is used to aid the ease of exposition for brevity given the diverse range of political parties that have existed over Australia's history. This grouping by no means reflects any political preference by the author.

reflected an economic development agenda based on promoting British interests. The establishment of rural industries such as agriculture and pastoralism were immediate priorities to support the needs of the early settlement population, soon developing into important export sectors along with the mining sector. Rural expansion, mining and mineral exploration were supported by the government through the development of agricultural colleges, the provision of extension services, financial assistance, land grants and licences to foster agricultural land use and mining activity.

In the late 1800s, the drought made water a significant issue calling for government involvement, especially as water was relied on to support the growth of the country's primary industries, particularly agriculture and mining. Water resource development, the introduction of irrigation in the late 1800s (first in Victoria) and government control of water were part of the 'drought proofing' policy to ensure economic growth. The importance of water resource developments varied across the states, for example, in the south-eastern states, the development of irrigation enabled rural expansion; in Western Australia, water was important for mining and the development of the state's goldfields and in Tasmania, water developments were tied to hydroelectricity developments. Linkages between water developments and developments in energy and food were hence evident. The development of both water supply, sewerage and drainage systems and electricity supply systems was a priority to support growing towns and cities and was the responsibility of state and local governments with some private sector involvement.

The period from federation to the 1970s was characterised by protectionist policies (tariffs and assistance) to support industrialisation, often favouring manufacturing industries (Bell 1997). With powers in trade and external affairs, the Commonwealth played an important role in the agriculture and mining sectors, to shield the sectors from external volatility, particularly during the interwar period.

Rural policy was characterised by the diversification of rural activity (from wool to food products), soldier settlement schemes (although ineffective), stabilisation of prices and the protection of farm incomes (Butlin, Barnard & Pincus 1982; McKay 1965; Wilson 2015). In the early decades, marketing cooperatives and the pooling of rural output systems were established. For example, in 1915, under an agreement between the Commonwealth and the states (New South Wales, Victoria, South Australia and Western Australia), the Australian Wheat Board implemented the Australian Wheat Marketing Scheme, providing for cooperation and control of the marketing of wheat across the states. Government-controlled marketing of rural products was a feature during the post-war period. Marketing schemes involved price stabilisation (guaranteed prices and home consumption prices), acquisition of products, control of purchase, sale and disposal. Other protectionist measures such as bounties and subsidies, trade controls including

export controls, bilateral agreements, guarantees and purchasing agreements as well as financial assistance and support for research continued throughout the period.

Policies from the late 1930s to the 1970s were aimed at the country's recovery and reconstruction during the post-war period. Population growth, economic development and full employment were economic objectives supported by encouraging immigration with a more open immigration policy, marking a shift away from the country's White Australia Policy.

The continued expansion of electricity systems and access was evident in the development of the Snowy Mountains Hydro-Electric Scheme and particularly in rural areas seen in the rural electricity subsidy schemes in NSW and Tasmania. Assistance with farming water, supported by legislation in NSW, Queensland and Victoria, highlighted the importance of supporting the needs of rural industries for both energy and water, thus drawing attention to the linkages between EWF.

Agricultural expansion remained an important policy objective and this was seen in the Commonwealth policy statement *A Rural Policy for Post-War Australia* (1947) which highlighted the importance of rural industries and the protection of the farmer's welfare as the government's main concern. Consideration of EWF linkages was also evident in the policy which mentioned both water and electricity. The statement discussed the importance of water conservation, more effective water storage, the adoption of irrigation projects, and the potential for governments to provide equipment to aid farmers to conserve water. The role played by the Commonwealth, however, was limited to financial assistance and policy collaboration with no direct involvement in achieving water objectives. This lack of involvement reflected the primacy of states in policy decision making and implementation and the limited scope for federal government intervention in water policy. While the policy also mentioned the importance of electricity access and the need to address the lack of access at the time, it did not note measures or strategies to improve electricity access (Commonwealth of Australia 1947).

Policies related to EWF continued to focus on the development of resources and in general, of the economy. A national approach to mining and water sector development was apparent in the creation of special councils, similar to the Australian Agricultural Council, including the Australian Minerals Council and the Australian Water Resources Council.

Rural policy reflected the Commonwealth's interest in the agricultural sector as a contributor to economic growth. The Commonwealth government played a large role in the sector as it became more export-oriented and continued to develop amidst wartime and recovery. The agricultural sector continued to benefit from protectionist policies. The promotion of agriculture was in line with developments in water resources. Water supply, sewerage and irrigation policies (state matters) involved the continued expansion of water systems, the construction of dams and other water-related infrastructure, the expansion of irrigation areas and research programs and were

focussed on ‘drought proofing’ and water resource development. Large infrastructure projects included the Ord River Scheme (WA), Burdekin Dam (Queensland) and Snowy Mountains Hydro-Electric Scheme (NWC 2011a, p. 24). The Snowy Mountains Hydro-Electric Scheme, serving both electricity and water needs, reflected the Commonwealth’s objectives for infrastructure development to provide for the rising needs of the growing population.

Linkages between EWF were formed during these early periods, shaped by both physical and environmental constraints as well as the broader policy context, which defined the role of EWF sectors in contributing to overall economic development and nation building.

8.1.2 EWF policies: 1970 to the present

A number of EWF policies have been developed at both national and state levels. The majority of policies reviewed in this section were developed by the Commonwealth, reflecting the rise in policy-making at the national level, particularly in energy and water sectors, areas historically governed by the states. This section discusses the main findings of the analysis of EWF policies.

Commonwealth

From 1970 to the present, the Commonwealth government has been responsible for a number of EWF policies and has played an important role in EWF sectors. Energy policies have gone through several phases, from addressing oil security, developing a national energy approach, energy sector reforms involving corporatisation and privatisation (of utilities and other government businesses), deregulation, industry restructuring, further market development, integration of energy policy and climate change policy and more recently, energy security challenges associated with the reliability of the current electricity system, energy shortages particularly in gas, state-wide blackouts and rising energy prices. The approach to addressing energy issues has typically involved ongoing reform with a continued emphasis on competition, efficiency and productivity. As international competitiveness and enhancing Australia’s position as an energy exporter (of mostly fossil) remains an important goal, developing and implementing bipartisan climate change policy to meet international commitments has been a challenge.

Water policy has evolved, contrasting with that of the previous periods, now with a key focus on the sustainable management of water, no longer driven purely by water resource development and growth interests. Rather than pursuing and consuming greater volumes of water, attention has been placed on adopting more sustainable water use and consumption (Tisdell, Ward & Grudzinski 2002). This has involved placing limits on the volume of water that can be withdrawn and ensuring a level of water quality that is compatible with social, industrial and environmental

needs. This has required substantial changes in the way water is governed, such as in the pricing of water, the operation of water markets and in the monitoring and collection of water information.

The food sector went through substantial changes. From a heavily protected and assisted sector, the agricultural sector has become one that is the least supported. During the 1970s, food policy was characterised by the phase-out of protectionist measures including farming assistance, a reduction in statutory marketing arrangements, the corporatisation of the many statutory boards for a number of rural products and an emphasis on structural adjustment schemes. By the 2000s, food policy focussed on further improving industry competitiveness and furthering the growth opportunities for the sector, both domestic and international.

EWF policies (1970-1999)

Table 8.1 lists the EWF-related policies as implemented by each party at the Commonwealth level from 1970 to 1999. It shows that the Labor government was responsible for both important policies, the *National Strategy for Ecologically Sustainable Development* (NSESD) and *National Competition Policy* (NCP).

Table 8.1: EWF policies by political party (1970-1999)

POLICY	LABOR	LIBERAL
Energy	• Energy 2000 National Energy Policy Paper 1988 • National Gas Strategy 1991 •	• Australian Energy Policy Review 1979 • Sustainable Energy Policy for Australia Green Paper • Safeguarding the Future Australia's response to Climate Change - Statement by the Prime Minister 1997 • Petroleum Marketing Policy 1998
Water	• Australian Water Resources Council Policy Statement 1975 • Water 2000 1983 • National Water Resources Development Program 1984 • Commonwealth Water Policy 1984 • Federal Water Resources Assistance Program 1984 • Murray Darling Basin Agreement 1992 • National Drought Policy 1992 • National Water Quality Management Strategy 1994 • COAG Water Reform Framework 1994 • Murray Darling Basin Cap 1995 • Guidelines for Groundwater Protection 1995	• National Water Resources Development Program 1978 • Commonwealth Water Policy 1979 • River Murray Water's Agreement 1982 • National Principles for the Provision of Water for Ecosystems 1996 • Salinity & Drainage Strategy 1999
Food	• Reform of Commonwealth Primary Industry Statutory Marketing Authorities Policy Statement 1986 • Economic & Rural Policy Statement 1986	• Treaty between Australia & New Zealand for a Joint Food Standards Systems 1996 • Advancing Australia's Statement - Rural Policy Package 1997

POLICY	LABOR	LIBERAL
	• Primary Industry & Rural Policy 1987 • Food & Nutrition Policy 1992 • Agri-Food Strategy 1992	
Other	• National Greenhouse Response Strategy 1992 • National Strategy for Ecologically Sustainable Development 1992 • National Competition Policy (NCP) 1995	• National Greenhouse Strategy 1998

While EWF policies since the 1970s have varied, there have been some similarities. During the 1970s, the policies developed were largely in response to significant issues affecting the sectors and the conditions at the time. In the energy sector, early policies were associated with redressing oil security, in the water sector, policies were associated with redressing environmental damage and unsustainable water withdrawals and use, and in the food sector, policies were associated with the need to boost industry performance. International competitiveness objectives were also common to the energy and food sectors. Ensuring security of supply in terms of availability was common to both energy and water policies during the period, more so than food security.

The policies during the 1970s reflected the need for a Commonwealth approach to address these issues that were affecting the nation. Policies for EWF, during these times, were increasingly developed at the national level, reflecting a national concern for EWF and requiring a national approach to EWF, which were historically matters of the state. The involvement of the Commonwealth government reflected the need to coordinate developments in these sectors across the states to ensure equitable development and to meet national economic objectives. National policies such as the NSESD (1992) and the NCP (1995) are examples of national-based policies that were implemented at the state level under the coordination of the Commonwealth government. COAG played a key role in such policymaking.

Despite the differences in the issues faced by the EWF sectors, an overall approach emphasising appropriate pricing, efficiency, competition and markets was adopted. These outcomes were pursued in all sectors, aligned with the objectives of economic reform, reflecting a standard solution to the various problems. Each sector was subject to the economic reforms of these times. Notions of sustainable management referring to the integration of economic, social and environmental considerations for long-term planning were also present in policy documents.

Consideration of EWF linkages (1970-1999)

Between 1970 and 1999, the most salient of EWF linkages seen in policy were largely between water and food. Historically, water policies have been influenced by the needs of the rural sector

underpinned by its contribution and role in achieving economic development and growth. The pursuit of rural expansion often involved subsidies for water to promote water consumption.

Water-related environmental problems such as erosion and salinisation, impacting on rural activities, inevitably led to changes in water policy. From a focus on exploitation to a more conscious consumption of water, water policies to an extent have become more water-focussed, less inclined towards purely agricultural interests. Rather, water policies have been driven by the need to manage the use and consumption of water while considering environmental impacts in addition to economic objectives. There has been heightened environmental consciousness. Since the 1970s, the shifts in water policy have been reflected at the national level as national water policy has become more prominent, in line with the increased recognition that water is a matter of national significance.

The linkages between energy and water, and energy and food were less prominent in policy than that observed at the ministerial and department level (see Chapter 7). However, linkages between EWF, have been increasingly important. Water has been an important input to energy supply, in mining and in the production of thermal electricity and hydropower. Food transport, production and processing also relied on a secure supply of energy. Both energy and food sectors have competed for land and water resources. The expansion of unconventional gas which has received much attention in Australia has brought rising concerns particularly relevant to water security and food security, linking goals for energy security (in terms of diversifying fuels sources). Strict regulation of the sector combined with strict environmental protections are necessary to minimise the potential negative impacts of unconventional gas on water and land (e.g. contamination with close impacts on communities). This has been an emerging and important subject highlighting the importance of accounting for the interlinkages between EWF.

From the 1970s to 2000, both the Liberal Coalition and the Labor parties were in power, from the Gorton Liberal and McMahon Liberal government in the early 1970s to the Whitlam Labor government from 1972 until 1975 when the Fraser Liberal government was in power, followed by the Hawke Labor government from 1983 and then the Keating Labor government in 1991 until 1996 when the Howard Liberal government came into power.

Water policies, *Australian Water Resources Council Water Policy Statement* (1975) and the two Commonwealth water policies (1979 and 1984) made some reference to energy and food. The goals of the first policy, *Australian Water Resources Council Policy Statement*, included the provision of water supplies to meet both the needs of people and industry, acknowledging 'power generation' (ABS 1976, p. 868). The following Commonwealth water policies (1979 and 1984), emphasised the importance of water and land management and the need for efficient water use, particularly irrigated agriculture (ABS 1980; Commonwealth of Australia 1985).

Water policies emphasised agricultural themes such as irrigation and rural water supply. For example, assistance programs such as the National Water Resources Development Program (1978) and the Federal Water Resources Assistance Program (1984) often targeted water resource development for agricultural purposes. The Murray-Darling Basin Agreement (1992) and the COAG Water Reform Framework (1994) reflected the need for water policy to govern agricultural water use.

Rural and agricultural policies conversely emphasised water themes. In the government's *Economic and Rural Policy Statement* (1986) and *Primary Industry and Rural Policy* (1987), reference was made to the importance of water resources and other natural resources such as soil (Australian Labor Party 1987; Commonwealth of Australia 1986). Water resource development programs were part of broader agendas to sustain rural industries, which in turn, were to contribute to the country's overall growth and development.

The government's 'Policies for Growth in Primary Industries' document (1988) discussed the interrelationships between research activities, for example, how energy research can inform farm cost structures and water and how soil and forestry research can impact land degradation issues (Kerin & Cook 1988). The document was another example of awareness of EWF linkages.

During the Keating Labor government, three important cross-sectoral policies were announced, namely the *National Strategy for Ecologically Sustainable Development* (NSESD), *National Greenhouse Response Strategy* (NGRS), both in 1992 and the *National Competition Policy* in 1995. While not exclusive to one sector, these policies applied to all EWF sectors, providing common objectives to which each sector could contribute, first to ecologically sustainable development, second to greenhouse emission reduction and thirdly to greater competitiveness of the economy. Each represented an area in which EWF could be managed jointly and in an integrated manner to meet common national goals.

The NSESD, in particular, promoted the need for an integrated approach to development considering economic, social and environmental aspects. The strategy targeted agriculture, mining and energy use and production, and transport as well as water resource management (an inter-sectoral issue) (Ecologically Sustainable Development Steering Committee 1992).

The concept of ecologically sustainable development was referenced in the *Food and Nutrition Policy* (1992), acknowledging the use of water and fossil fuels and the need for the food system to 'maintain the quality and integrity of the environment' (Department of Health 1992, p. 10). By improving energy use in manufacturing methods, the policy sought to contribute to ecologically sustainable development.

Ecologically sustainable development was also the focus of the *National Water Quality and Management Strategy* (1994) which acknowledged water use by various industries (agriculture, hydroelectric power generation, food and beverage industry and petroleum) and the impacts such sectors have on water quality (ARMCANZ & ANZEC 1994b). These industries were also described in the *Guidelines for Groundwater Protection* (1995) which noted energy generation, town gas sites, agriculture and agribusiness, mining, mineral industries and the food processing industry as sources of groundwater contamination (ARMCANZ & ANZEC 1995).

No other policies during the period made reference to the other sectors and were sector-specific.

EWF policies (2000-Present)

Unlike food policies, energy and water policies during the period reflected the need to address a number of serious and ongoing concerns, particularly regarding energy and water security. Each sector has continued to deal with its own sector-specific issues. Table 8.2 lists the EWF-related policies developed by each party at the Commonwealth level from 2000 to the present.

Table 8.2: EWF policies by political party (2000-Present)

POLICY	LABOR	LIBERAL
Energy	• National Energy Security Assessment 2009 • COAG National Strategy on Energy Efficiency 2009 • Commencement of Carbon Pricing 2011 • National Energy Security Assessment 2011 • Carbon Farming Initiative (CFI) 2012 • COAG Energy Market Reform Implementation 2012 • Australia's Energy Transformation - Energy White Paper 2012 • Intergovernmental Agreement on Energy Supply Industry Safety 2012 • Securing a Clean Energy Future - Implementing the Australian Government's Climate Change 2012 • Implementation of National Energy Customer Framework	• COAG Towards a National Energy Policy 2001 • Mandatory Renewable Energy Target 2001 • Australian Energy Market Agreement 2004 • Securing Australia's Energy Future - Energy White Paper 2004 • Domestic Gas Strategy 2015 • Energy White Paper 2015 • Gas Market Development Plan 2015 • National Energy Productivity Plan 2015 • National Harmonised Regulatory Framework for Natural Gas from Coal Seams 2015 • Australian Gas Security Mechanism 2017 • Finkel Review Independent Review into the Future Security of the National Electricity Market 2017 • COAG Implementation of Finkel Review 2017
Water	• COAG Work Program on Water 2008 • IGA on Murray-Darling Basin Reform 2008 • Referral of state powers over MBD to Commonwealth 2008 • National Water Market System 2009 • Water for the Future 2010 • Murray Darling Basin Plan 2012	• Draft National Water Policy Agenda 2000 • National Action Plan for Salinity & Water Quality 2000 • Living Murray Program 2002 • IGA on a National Water Initiative 2004 • National Plan for Water Security 2007 • National Groundwater Strategic Framework 2016-2025 2016 • Implementation of the Basin Plan 2017

POLICY	LABOR	LIBERAL
Food	• National Food Plan Green Paper 2012 • Our Food Future National Food Plan White Paper 2013	• Food Regulation Agreement 2000 - Model Food Provisions 2000 • National Food Industry Strategy 2002 • Agricultural Competitiveness White Paper 2015

Note: IGA – Intergovernmental Agreement

There were few differences between the policies developed and implemented by the two parties, the Labor and Liberal coalition parties. Over this period, water policy and food policy continued to follow the same trajectory, reflecting bipartisan support for common goals such as water reform and MDB management, growth and international competitiveness in the agricultural and food sector. While both parties have focussed on ensuring reliable and competitively priced energy, the main difference in the policies of the two parties has been in energy policy and more precisely, climate change. The differences in energy policies have had implications on energy policy-making and implementation and also water and food policies (sectors sensitive to climate change).

Climate change has been a divisive issue for both Labor and Liberal parties and has intersected with energy policy. Although both parties have, in the past, shown some acceptance of the need to address climate change (seen in the support for renewable energy evident in past policy) motivated by economic, environmental and social concerns, much of the differences have been associated with the types of strategies and measures (e.g. carbon pricing, emissions trading, direct action).

The transition towards a low carbon economy has been a challenge for Australia, given its historical dependence on fossil fuels to meet domestic needs and earn export revenue. While willingness to reduce emissions was evident since the early 1990s at the national level as seen with the *National Greenhouse Response Strategy*, the *National Strategy for Ecologically Sustainable Development* and the *National Sustainable Energy Policy* (all introduced by the Keating Labor government), such willingness has been influenced by economic and social considerations. This was seen particularly when former Prime Minister Howard rejected the need for what he considered as strict obligations (by the Kyoto Protocol) on reducing emissions that would disadvantage the economy[19]. The main challenge of climate change policy has been the need to balance economic growth interests (short term) with environmental interests (long term). Any climate policy that imposes what could be perceived as an unnecessary burden on the economy has often been politically and socially unacceptable. For example, carbon pricing and

[19] See *Safeguarding the future: Australia's response to climate change (Howard 1997)*.

emissions trading schemes have been difficult to implement. More recently, the attempts by the Liberal government to legislate emissions reductions targets have failed.

The differences in the party positions on climate change creates difficulties in reaching consensus and subjects energy policy to potentially large changes should government change, thus creating policy uncertainty. While changes in government may result in subtle changes to water and food policy (if not any), it could lead to significant and disproportionate changes in energy policy, as has been the case in recent years. Energy policy has been sensitive to policy cycles (Pritchard 2017). Changes in government at both the national and state level can affect the composition of the COAG Energy Council, and this could interfere with long-term goals should energy priorities change.

The differences in party views not only prevents bipartisanship needed for the implementation of energy policy, it also affects the long-term policy integration of EWF. If greater integration between EWF policies were to be initiated by one government, there is a risk that a change in government would undermine EWF policies, particularly if the energy component of these integrated policies were to change substantially. The likelihood of energy policy change and the potential for the reversal of energy policies would, therefore, impact on the long-term policy objectives of water and food policies and create uncertainty.

The problem is compounded particularly because these differences exist at the Commonwealth level which prevents the Commonwealth government providing a long-term national approach to energy, needed for long-term integrated planning and to guide state policy-making and implementation. Political acceptance is an important consideration for EWF policy.

Consideration of EWF linkages

The period from 2000 to the present has been characterised into three main periods corresponding with changes in government from the Howard Liberal government from the start of the millennium to 2007, the Rudd and Gillard Labor governments from 2007 to 2013 and the Abbot, Turnbull and recently Morrison Liberal governments from 2013 to the present. EWF policies since 2000 to the present continued to address a number of serious issues such as energy and water security. There have been few differences between the policies developed and implemented by the two parties, the Labor and Liberal coalition parties.

An analysis of policies from 2000 to the present showed little integration between EWF. During the Howard government, policies made minor references to other sectors. The NWI (2004) discussed water for various uses including irrigation, industry and mining, seeking to improve access entitlements to govern water across these users. While no specific mention was given to farming users (although assumed), attention was given to the mineral and petroleum sectors and

the need for further action beyond the NWI to manage water use and the water-related impacts by those sectors (COAG 2004, p. 6. para. 34). There was no mention, however, regarding water planning and other energy-related users (e.g. power generation). The only inter-sectoral references made were in relation to irrigation, seen throughout the document. The analysis hence showed the inconsistencies between the conditions for water use by agriculture and those for mining and extractive industries. The *National Plan for Water Security* (2007) also reflected food linkages with an emphasis on irrigation infrastructure as a key component for improving water security (Howard 2007). The government's *Energy White Paper* (2004) made little reference to water and food, mentioning water in the context of the environmental impacts of energy production and mentioning food-related issues only with reference to agriculture as one of the largest greenhouse gas emitters. There was no mention of water or food as part of its policy actions (Energy Task Force 2004).

Policies during the Howard government showed a lack of integration between EWF policies. Other policies during the term, however, made no mention of the other-related sectors. Energy-related reforms were concerned with energy market development and made no mention of impacts on water or food. The disconnect between EWF was consistent with the separation of portfolio and ministerial responsibilities where water and food responsibilities were combined while energy remained a separate responsibility. The linkages between water and food were important, particularly during times of drought where the management of water by agricultural users was a means for dealing with water security issues.

Some integration between EWF was evident in policy during the Rudd and Gillard Labor Governments from 2007 to 2013. Water policies such as the *Water for the Future* (2010) policy continued to target agricultural water use and to improve efficiency through irrigation management (Department of Sustainability 2010). Energy-related and climate policies, however, appeared to consider the other water and food sectors. The *Carbon Farming Initiative* (CFI) in particular demonstrated consideration of EWF linkages. The CFI allowed farmers and land managers to earn carbon credits by storing carbon or reducing greenhouse gas emissions on the land based on eligible activities. By providing a list of activities that would not be eligible for the CFI, excluding activities that may have negative impacts on land access for agricultural production, the availability of water, conservation of biodiversity, employment and the local community, the initiative was designed to avoid impacts on both water and food security (Department of the Environment and Energy 2018c).

The government's *Energy White Paper* (2012) referenced other related water and food sectors however in its discussion of factors determining energy security, it neglected to mention the interrelated securities of water and food security. It highlighted the importance of water

availability by acknowledging the potential for increased risks to energy security. A whole chapter of the policy document was dedicated to discussing sustainability, especially promoting the need for integrated energy and water policy and recognising the importance of water in electricity generation for hydroelectricity and cooling coal or gas-fired thermal generation (Department of Resources 2012).

Other mentions of water and energy linkages were associated with the risks of investing in water-intensive technology, reduced water availability (leading to higher wholesale prices) as well as the need for the safe development of unconventional gas. Consideration of food impacts was also evident. These were related to the conflicts between mineral resource development and agriculture.

The *Clean Energy Future Plan* (2012) did not mention water but mentioned food-related aspects. Part of the plan included the Clean Technology Food and Foundries Investment Program involving assistance to food and foundry manufacturing businesses (trade-exposed business) to invest in energy efficiency equipment and low-pollution technologies (Combet 2012). It acknowledged the importance of the food and food manufacturing business to contribute to lower emissions. In the *National Food Plan Green Paper* (2012) and *White Paper* (2013), energy and water were discussed throughout with an emphasis on the need to ensure energy and water for food production and the role that energy and water play in meeting food goals (Department of Agriculture 2012, 2013). In 2013, the *National Harmonized Regulatory Framework for Natural Gas from Coal Seam Gas* discussed the management of agriculture, land and water, recognising the impacts of gas exploration on natural resources and hence recognising the interlinkages between all three sectors (Standing Council on Energy and Resources (SCER) 2013).

The policies of the Gillard Labor government demonstrated to a greater extent consideration of the interrelationships between EWF, despite the separation of responsibilities at the portfolio, ministerial and department level. Although the Rudd Labor government returned during the second half of 2013, no new EWF policies were implemented under this government.

The EWF policies during the Liberal governments of Abbot and Turnbull featured some mention of other sectors. Both the *Domestic Gas Strategy* (2015) and the *Energy White Paper* (2015) considered water and agriculture aspects in the context of gas development (Department of Industry and Science (DIS) 2015a, 2015b). The *National Groundwater Strategic Framework* (2016) also acknowledged the importance of planning for energy and agricultural developments (Australian Government 2016). The *National Energy Productivity Plan* (2015) only mentioned agriculture as an industry for which energy cost savings could be made (COAG Energy Council 2015). Currently, energy and water linkages are seen in the government's plan to extend the capacity of the Snowy Mountains Hydro-Electric Scheme, *Snowy 2.0*.

In the *Agricultural Competitiveness White Paper* (2015), water was a key element centred on building water infrastructure and managing the risks of drought. Energy aspects were also considered in terms of the energy intensity of such infrastructure and the potential for high energy costs (Commonwealth of Australia 2015). In the *National Food Waste Strategy* (2015), reference to water and energy was in terms of wasted resources associated with food waste. It advocated that preventing food waste would hence prevent wastage of other resources such as water and energy and positive environmental outcomes could be achieved (Commonwealth of Australia 2017).

Some integration is evident in EWF policies, particularly in the considerations of EWF linkages in related gas and groundwater policy. However, policies are still representative of their sectors, and over the years, there has been no fully integrated EWF policy.

Summary

From the 1970s to the present, EWF policies have evolved in response to changes in broader socio-economic, political and environmental contexts. The analysis found that Commonwealth policies over recent years have demonstrated some integration between EWF policies, with attention to important EWF linkages. This was evident in efforts to better manage water use, particularly by agricultural water users and more recently, discussion regarding the interrelated impacts of unconventional gas development (posing trade-offs between energy security, and water and food security through the potential impacts on water and land resources). In enhancing the agricultural sectors growth and competitiveness, attention has been placed on securing water (mostly with emphasis on infrastructure development).

Despite some integration, it appeared, however, that to a larger extent, policies have been mostly separate and sector-specific. The framing of policy goals and objectives has suggested that policy-making occurs in isolation. While the focus for energy policy has centred on lower prices, availability and reliability, and for food policy, continued growth and competitiveness, water policy has aimed at achieving more sustainable consumption and water use. Water policies, which are important particularly in the context of Australia, can limit the outcomes of energy and food policies if energy and food sectors cannot secure their water requirements. As a result, there are trade-offs between economic and environmental objectives. Achieving water and energy efficiencies through investment in infrastructure and technology has been one solution, but the discussion of efficiency strategies takes place in separate policies, showing that there is little cohesion between efficiency goals and measures between sectors. This could lead to the setting of efficiency goals that are too high or too low, and subsequently, the development of strategies that may be too costly or insufficient. Greater cohesion between policies may reduce these risks. For example, cohesion between energy and food policies may lead to a fairer and potentially less

costly sharing of the burden to reduce or conserve water use through efficiency. Joint planning of energy and food water use may furthermore enable the sectors to take better advantage of water markets.

EWF policies have often been implemented by separate government departments. While this is partly consistent with integration at the portfolio, ministerial and organisational level, (discussed in the previous chapter), integration at these levels (portfolio, ministerial and organisational), did not always explain integration at the policy level, particularly during the Gillard Labor government where ministers had separate EWF responsibilities.

Over the period, no policies were developed that dealt simultaneously and comprehensively with the interrelated challenges of EWF security. Policies were discussed separately with minor mention of other related sectors. Table 8.3 lists the EWF policies at the Commonwealth level and the extent to which other sectors have been mentioned.

The differences in EWF policies and the attention to sector issues may suggest difficulties for integrating EWF. Interrelated impacts have not been well considered in past and current policy. The analysis also highlights the importance of political agreement that further complicates the integration of EWF policy. As policies develop on their own and as they are framed as separate issues with separate debate, the more difficult it appears to integrate policy.

Table 8.3: Commonwealth EWF Policies

PARTY	LEADER	POLICY	E	W	F	O
Labor	Whitlam (19/12/1972-11/11/1975)	Australian Water Resources Council Policy Statement 1975	✓	■	✓	
Liberal	Fraser (11/11/1975-11/03/1983)	Australian Energy Policy Review 1979	■			
		Commonwealth Water Policy 1979		■	✓	
Labor	Hawke (11/03/1983-02/01/1992)	National Conservation Strategy for Australia 1983		■		
		Water 2000 1983		■	✓	
		Commonwealth Water Policy 1984		■	■	
		Economic and Rural Policy Statement 1986		✓	■	
		Primary Industry and Rural Policy 1987		✓	■	
		Energy 2000 A National Energy Policy Paper 1988	■			
		National Gas Strategy 1991	■			
Labor	Keating (2/01/1992-11/03/1996)	National Energy Management 1992	■			
		National Drought Policy 1992		■		
		Agri-Food Strategy 1992			■	

		Food and Nutrition Policy 1992	✓	✓	■	
		National Greenhouse Response Strategy 1992	✓✓	✓✓	✓✓	■
		National Strategy for Ecologically Sustainable Development 1992	✓✓	✓✓	✓✓	■
		COAG Water Reform Framework 1994		■	✓✓	
		National Water Quality Management Strategy 1994	✓	■	✓✓	
		National Sustainable Energy Policy Discussion Paper 1995	■	✓		
		National Competition Policy 1995	✓✓	✓✓	✓✓	■
		Guidelines for Groundwater Protection 1995	✓	■	✓	
Liberal	Howard (11/03/1996-03/12/2007)	Sustainable Energy Policy for Australia Green Paper 1996	■	✓		
		National Principles for the Provision of Water for Ecosystems July 1996		■		
		Advancing Australia's Statement - Rural Policy Package 1997			■	
		National Gas Pipelines Access Agreement 1997	■			
		National Greenhouse Strategy 1998				■
		Salinity and Drainage Strategy 1999		■	✓✓	
		National Action Plan for Salinity and Water Quality 2000		■		
		Food Regulation Agreement 2000 Model Food Provisions 2000			■	
		COAG Towards a National Energy Policy 2001	■			
		Mandatory Renewable Energy Target 2001	■			
		National Food Industry Strategy 2002			■	
		Australian Energy Market Agreement 2004	■			
		Energy White Paper 'Securing Australia's Energy Future' 2004	■	✓✓	✓	
		National Water Initiative 2004	✓	■	✓✓	
		National Plan for Water Security 2007		■	✓✓	
Labor	Rudd (3/12/2007-24/06/2010)	National Strategy on Energy Efficiency 2009	■	✓		
	Gillard (24/06/2010-27/06/2013)	Water for the Future 2010		■	✓✓	
		Energy White Paper 2012 ‘Australia’s transformation’	■	✓✓	✓✓	
		Securing a Clean Energy Future: Implementing the Australian Government's Climate Change Plan 2012	■		✓	
		Australia in the Asian Century 2012	✓	✓	✓	■
		Murray Darling Basin Plan 2012		■	✓✓	

		National Food Plan White Paper 'Our Food Future' 2013	✓	✓✓	■	
Liberal	Abbot (18/09/2013-15/09/2015)	Emissions Reductions Fund White Paper 2014	✓	✓	■	
		Domestic Gas Strategy 2015	■	✓✓	✓✓	
		Energy White Paper 2015	■	✓	✓	
		Agricultural Competitiveness White Paper 2015	✓	✓✓	■	
	Turnbull (15/09/2015-24/08/2018)	National Energy Productivity Plan 2015	■		✓	
		National Harmonised Regulatory Framework for Natural Gas from Coal Seams 2015	■	✓✓	✓	
		National Groundwater Strategic Framework (2016-2025) 2016	✓✓	■	✓✓	
		Defence White Paper 2016	✓	✓	✓	■
		National Food Waste Strategy 2018	✓	✓	■	

Note: E – Energy, W – Water, F – Food ■ - indicates the type of policy, ✓ - indicates reference to other sector (✓- minor, ✓✓ - moderate, ✓✓✓ - major)

States

The analysis of integration between EWF within state policies appeared to vary across the states. However, there was limited integration and considerations of inter-sectoral aspects. Water and food linkages were the most apparent, particularly in water policies, except for the water policies in the ACT. Overall, most references to other sectors were minimally associated with themes such as water and energy efficiencies and irrigation, reflecting physical linkages between EWF resources. Most policies were sector specific, and no joint EWF policy was developed in any state. Water policy papers such as the *Water for Good* (2015) paper in SA, however, referred to agriculture and energy sectors throughout. Consideration of EWF was, in particular, reflected in state policies (economic and also climate change policies) but this did not necessarily mean consideration of inter-sectoral linkages (Office for Water Security 2010). While some policies were made during times where ministers had cross-sectoral responsibilities, this did not necessarily mean that policies were correspondingly cross-sectoral.

New South Wales

Table 8.4 lists the policies and the extent to which other sectors have been mentioned. In NSW, while no joint EWF policy exists, there is some recognition of other sectors in EWF policies. Consideration of EWF linkages reflects integration at the decision-making level. Only during the O'Farrell government were ministers for EWF separated.

Table 8.4: EWF Policies in NSW

PARTY	LEADER	POLICY	E	W	F	O
Labor	Carr (2/05/1995-3/08/2005)	State Groundwater Policy Framework Document 1997	✓	■	✓	
		Policy for Sustainable Agriculture 1998		✓	■	
		Groundwater Quality Protection Policy 1998	✓	■	✓	
		Water Conservation Strategy 2000	✓	■	✓✓	
Liberal	O'Farrell (28/03/2011-17/04/2014)	NSW 2021 2011	✓✓✓	✓✓✓	✓✓✓	■
		Energy Efficiency Action Plan 2013	■	✓	✓	
		Renewable Energy Action Plan 2013	■	✓	✓	
Liberal	Baird (17/04/2014-23/01/2017	Gas Plan November 2014	■	✓✓	✓✓	
		Agriculture Industry Action Plan - Primed for Growth, Investing Locally, Connecting globally 2014	✓	✓✓	■	
		NSW Government Food Safety Strategy 2015-2021 2015		✓	■	
		Right to Farm Policy 2015			■	
		Climate Change Policy Framework 2016	✓✓✓	✓✓✓	✓	■
		Water Resource Plans Roadmap 2016		■	✓	
Liberal	Berejiklian (23/01/2017-Present)	Water Reform Action Plan 'Securing our water' 2017		■	✓	
		Metropolitan Water Plan 2017	✓	■	✓	

Note: E – Energy, W – Water, F – Food ■ - indicates the type of policy, ✓ - indicates reference to other sector (✓- minor, ✓✓ - moderate, ✓✓✓ - major)

Table 8.4 shows that for the majority of policies, there was only minor to moderate mention of other sectors. Energy policies made minor mention of water and food aspects, in particular, the *Gas Plan* (2014) (NSW Government 2014). Water policies made minor mention of energy and food but mostly food-related agriculture aspects. Food-related policies however mostly took into account water. Only the *Agriculture Industry Action Plan* (2014) made reference to energy in the context of investing in critical infrastructure (Department of Primary Industries 2014).

The *NSW2021* (2011) made major references to EWF which were the focus of a number of strategic goals (although separate goals) (NSW Department of Premier and Cabinet 2011). In the *Climate Change Policy Framework* (2016), both energy and water were important aspects, however, only minor reference was given to food (NSW Office of Environment and Heritage 2016). The table also shows differences in the times when EWF policies were developed, showing that during the Carr government, water policies were mostly developed; during the O'Farrell government, energy policies were developed in addition to the state economic plan; during the Baird government, a number of food-related policies were developed and during the recent

Berikijiian government, water policies were developed. It appears that each government had a focus on one sector.

Victoria

Table 8.5 lists the various policies in Victoria and the extent to which other sectors have been mentioned. In Victoria, while no joint EWF policy exists, there was some recognition of other sectors in the EWF policies. Integration at the decision-making level was seen at the department level but not at the ministerial level during the governments listed in Table 8.5, as ministers had separate EWF responsibilities.

Table 8.5: EWF Policies in Victoria

PARTY	LEADER	POLICY	E	W	F	O
Labor	Cain Jnr (8/04/1982-10/08/1990)	Renewable Energy Strategy - Government Energy Policy Statement 1989	■	✓	✓	
Labor	Bracks (21/10/1999-30/07/2007)	Energy for Victoria Ministers Statement 2002	■	✓		
		Food For All 2005			■	
Labor	Andrews (3/12/2014-Present)	Victorian Traditional Owner Water Policy Framework 2014		■		
		Energy Efficiency and Productivity Statement 2015	■	✓		
		Victoria's Renewable Energy Roadmap 2015	■	✓		
		Climate Change Adaptation Plan 2017-2020 2016	✓✓	✓✓	✓✓	■
		New Energy Technologies Sector Strategy 2016	■			
		Food and Fibre Sector Strategy 2016		✓✓	■	
		Water For Victoria Water Plan 2016	✓✓	■	✓✓	
		Climate Change Framework 2017	✓✓	✓✓	✓✓	■
		Renewable Energy Action Plan 2017	■	✓		
		Agriculture Victoria Strategy 2017		✓✓	■	

Note: E – Energy, W – Water, F – Food ■ - indicates the type of policy, ✓ - indicates reference to other sector (✓- minor, ✓✓ - moderate, ✓✓✓ - major)

The majority of the policies reviewed included the most recent EWF policies of the Labor government. The government developed policies in each sector, showing that the two climate change-related policies made moderate mention of all sectors. Water and food linkages were captured in the agricultural policies and the *Water for Victoria Plan* (2016), which made moderate mention of both energy and food sectors. Energy policies appeared separate with only minor mention to water aspects (Department of Environment Land Water and Planning 2016).

Queensland

Table 8.6 lists the various policies in Queensland and the extent to which other sectors have been mentioned. Policies in Queensland for EWF were neither well integrated with only very minor mention of other sectors. Although integration at the decision-making level was seen mostly between energy and water, energy policies reflected very little consideration of water aspects.

Table 8.6: EWF Policies in Queensland

PARTY	LEADER	POLICY	E	W	F	O
Labor	Bligh (13/09/2007-26/03/2012)	Environment Protection Act 1994 Environment Protection (Water) Policy 2009	✓✓	■	✓✓	
		Renewable Energy Plan 2009	■	✓	✓	
		Energy Management Plan 2011	■	✓	✓	
		Food for a growing economy - An economic development framework for the Queensland food industry - Draft Policy Framework	✓	✓	■	
Liberal	Newman (26/03/2012-14/12/2015)	Food and Fibre Policy 2015			■	
Labor	Palaszczuk (14/12/2015-Present)	Climate Adaptation Strategy 2017	✓✓✓		✓✓✓	■
		Climate Change Transition 2017	✓✓✓	✓	✓	■
		Powering Queensland Plan 2015	■	✓	✓	
		Agriculture and Food Research, Development and Extension 10 Year Roadmap and Action Plan 2018		✓	■	

Note: E – Energy, W – Water, F – Food ■ - indicates the type of policy, ✓ - indicates reference to other sector (✓- minor, ✓✓ - moderate, ✓✓✓ - major)

Unlike other states, water is managed under the state's Environmental Protection Act which considers both energy and agriculture as part of the environmental values which guide the Act. Most policies only made very minor mention of other sectors and were hence mostly sector specific. Only the recent climate change policies made major references to energy and food.

South Australia

Table 8.7 lists the EWF policies discussed and the extent to which other sectors have been mentioned. Since 2010, a policy for each sector has been developed. Of all the policies, the state's water plan *Water for Good* (2010) water plan is most integrated and considers the energy and food sectors, although the food policies also considered both the water and energy sectors (Office for Water Security 2010). The energy plan was the least integrated with barely any mention of the water and food sectors (South Australian Government 2017).

Table 8.7: EWF Policies in SA

PARTY	LEADER	POLICY	E	W	F	O
Labor	Rann (5/03/2002-21/10/2011)	Water For Good 2010	✓✓✓	■	✓✓✓	
		South Australian Food Strategy 2010	✓	✓✓	■	
Labor	Weatherill (21/10/2011-18/03/2018)	Premium Food and Wine from our Clean Environment 2015	✓	✓✓	■	
		Climate Change Strategy - Towards a low carbon economy 2015	✓✓	✓✓✓	✓	■
		Our Energy Plan 2017	■	✓		

Note: E – Energy, W – Water, F – Food ■ - indicates the type of policy, ✓ - indicates reference to other sector (✓- minor, ✓✓ - moderate, ✓✓✓ - major)

Tasmania

Table 8.8 lists the EWF policies discussed and the extent to which other sectors have been mentioned. Some integration of EWF was evident in Tasmania's EWF policies. Since 2014, only the water and food sectors have combined the responsibilities of ministers. The table shows that the *State Policy of Protection of Agricultural Land* (2009) made moderate mention of the water and energy sectors along with the *Climate Change Action Plan* (2017) which made mention of all three sectors (Department of Premier and Cabinet 2009; Tasmanian Climate Change Office 2017). Other than the *State Policy on Water Quality Management* (1997) which made moderate reference to food, the rest of the policies only made minor mention of the other sectors (Tasmanian Government 1997).

Table 8.8: EWF Policies in Tasmania

PARTY	LEADER	POLICY	E	W	F	O
Liberal	Rundle (18/03/1996-14/09/1998)	State Policy on Water Quality Management 1997		■	✓✓	
Labor	Lennon (21/03/2004-26/05/2008)	Water Resources Policy - Enforcement Policy for the Water Management Act 1999		■		
Labor	Bartlett (26/05/2008-24/01/2011)	State Policy on the Protection of Agricultural Land 2009	✓✓	✓✓	■	
Labor	Giddings (24/01/2011-31/03/2014)	Food for all Tasmanians 2012	✓	✓	■	
Liberal	Hodgman (31/03/2014-Present)	Energy Strategy Restoring Tasmania's Energy Advantage 2015	■	✓	✓	
		Tasmania's Sustainable Agri-Food Plan 2016	✓	✓✓	■	
		Growing Tasmanian Agriculture - Research, Development and Extension to 2050 2017			■	

	Climate Action 21-Tasmania's Climate Change Action Plan 2017	✓✓	✓✓	✓✓	■

Note: E – Energy, W – Water, F – Food ■ - indicates the type of policy, ✓ - indicates reference to other sector (✓- minor, ✓✓ - moderate, ✓✓✓ - major)

Western Australia

EWF policies in Western Australia were mostly sector specific with very minor references to the other sectors. The *State Water Plan* (2007) was the only policy to make moderate reference to energy (Department of the Premier and Cabinet 2007) .

Table 8.9: EWF Policies in WA

PARTY	LEADER	POLICY	E	W	F	O
Labor	Carpenter (3/02/2006-3/02/2006)	State Planning Policy 2.9 Water Resources 2006		■	✓	
Labor	Carpenter	State Water Plan 2007	✓✓	■	✓	
Liberal	Barnett (23/09/2008-16/03/2017	Strategic Energy Initiative Energy 2031 2012	■	✓		
		Securing WA's water future-Position paper-Reforming water resource management 2013	✓	■	✓	
		Pathway to improving food security 2014		✓	■	
		Agrifood 2025+ 2017			■	

Note: E – Energy, W – Water, F – Food ■ - indicates the type of policy, ✓ - indicates reference to other sector (✓- minor, ✓✓ - moderate, ✓✓✓ - major)

Northern Territory

Only in the Northern Territory was there an integrated policy, the *Strategy for NT Utilities* (2016), covering both energy and water sectors (Department of Treasury and Finance 2016). Other policies, however, made minor mention of the other sectors. The water policy made moderate mention of food-related and energy-related aspects, recognising water as an important input to the mining, petroleum and agriculture sectors.

Table 8.10: EWF Policies in the NT

PARTY	LEADER	POLICY	E	W	F	O
Liberal	Giles (13/03/2013-31/08/2016)	Our Water Future 2015	✓	■	✓✓	
		Health Nutrition and Physical Activity Strategy 2015-2020		✓	■	
		Strategy for Northern Territory Utilities 2016	■	■		

Labor	Gunner (31/08/2016-Present)	Roadmap to Renewables 2017	■	✓		

Note: E – Energy, W – Water, F – Food ■ - indicates the type of policy, ✓ - indicates reference to other sector (✓- minor, ✓✓ - moderate, ✓✓✓ - major)

Australian Capital Territory

Policies in the ACT, as shown in the table, were sector specific with minimal mention of the other sectors.

Table 8.11: EWF Policies in the ACT

PARTY	LEADER	POLICY	E	W	F	O
Labor	Stanhope (12/11/2001-16/05/2011)	Think Water, Act Water 2004		■		
Labor	Gallagher (16/05/2011-10/12/2014)	Sustainable Energy Policy 2011-2020 2011	■	✓		
		ACT Water Strategy-Striking the Balance 2014-2044 2014		■		
Labor	Barr (10/12/2014-Present)	Draft ACT Water Resource Plan for surface water and groundwater 2016		■	✓	
		Canberra 100% Renewable 2016	■			

Note: E – Energy, W – Water, F – Food ■ - indicates the type of policy, ✓ - indicates reference to other sector (✓- minor, ✓✓ - moderate, ✓✓✓ - major)

Summary

The analysis of policies at the state level shows that EWF policies were mostly separate and no joint policy existed specifically for EWF in any state. While some policies made reference to other sectors, they were mentioned in a very minor way and not to the extent that the consideration of other sectors appeared to shape policies. Policies were mostly sector specific.

8.2 Legislation

The review of legislation focuses on some of the main pieces of legislation made to support the implementation of broader EWF policies over the five main periods.[20]

[20] A list of legislation cited in this section is provided in Appendix D.

8.2.1 EWF legislation: Early developments to 1969

While a number of laws were enacted since self-government related to mining, agriculture, electricity and gas development, only the main pieces of legislation were reviewed. Electricity legislation along with mining legislation was a feature of energy legislation during the earlier years. Various acts provided for the construction and charging of works by local government and special electricity authorities. From the late 1800s to the beginning of the 1900s, local council and municipality acts were important in specifying the powers and responsibilities of local councils in matters of electricity and gas, water and sewerage (construction of works and the provision of services) and food (operation of abattoirs and marketplaces).

During the earlier periods, legislation was particularly important for water management. From the late 1800s to the early 1900s, rising competition for water for mining and agricultural purposes and urban services called for the need for some form of water control (Tisdell, Ward & Grudzinski 2002). For the south-eastern states, water regulation was important given drought, and concerns about the country's water variability, previously unanticipated and different to the water conditions of Britain on which water governance was inappropriately based. The late 1800s marked the beginning of water legislation across the states and the formalisation of rules concerning water usage and rights to water. It especially marked the end of the English common law riparian system as a means of managing water resources with the introduction of water rights through water license systems.

An important piece of legislation during the period was the Irrigation Act 1886 in Victoria, which enabled the government to have greater control over the use of water over the private rights of individuals. The act specifically vested in the government the right to use water in any stream, lake or swamp provided that no riparian rights could be established which might prevent the use of water for irrigation. It further authorised the construction of government works and provided finance for irrigation trusts to conduct local schemes (ABS 1948, p. 1098). The legislation hence set the scene for government control over water resources. Over the following periods, water legislation was introduced in the majority of states.

Water legislation had several objectives, these being to declare the rights of the Crown and other persons for using and controlling water, to provide for conservation and supply of water and for regulating drainage, to provide for the granting of licenses to construct and maintain water-related works to impose charges for water. Legislation also provided for the protection of water, for example, from pollution and other undesirable uses such as the wasteful use of water (*Country Towns Water and Sewerage Act* 1880, s 46). In relation to energy sectors, to reflect consideration of energy and water linkages, legislation protected against the pollution of water from gas development (*Country Towns Water and Sewerage Act* 1880, s 55).

Water Acts covered the use and right to water for many purposes, including agriculture, irrigation and domestic use. While water rights were an important feature of water resource management, they were not consistent across sectors. Water rights for mining were separate and not subject to common water legislation which was mostly for agricultural users. Water legislation specified the protection of mining rights to water determined by existing mining acts. Miners had special water privileges relative to agricultural users. These special privileges indicated a separation of water rights systems.

The River Murray Act 1915 was the only water-related act administered by the Commonwealth government in connection with NSW, Victoria and SA regarding the sharing of the water resources of the River Murray between the states. The legislation reflected the importance of the multiple uses of water, particularly related to agriculture, irrigation and navigation and the need to secure water resources.

A number of acts were passed related to the agricultural sector, including the Bounty Act 1907 and other specific commodity acts, including export control acts and marketing acts. State legislation to provide for farm water supplies in NSW, Victoria, and Queensland during 1946 reflected linkages between water and agriculture and the need to secure water to achieve agricultural objectives. Another important act was the Snowy Mountains Hydro-Electric Power Act 1949 that defined the powers of the Snowy Mountains Hydro-Electric Authority over water and electricity. As the government became highly involved in the economy, there was a rise in legislation and regulation. For example, in the agricultural sector, a number of specific laws were implemented to support the marketing arrangements and international trade arrangements of various food products.

Table 8.12 lists some of the first pieces of legislation introduced for the EWF sectors. State legislation on the mining, water and electricity sectors along relevant local acts and land legislation were the first pieces of legislation to define the legislative framework for EWF. Most legislation coincided with Labor governments. While each state enacted legislation in each of the three sectors, there were fewer pieces of cross-sectoral legislation. Energy and water legislation existed at the Commonwealth level and in NSW, Queensland, Tasmania and the ACT.

Such laws covered issues related to hydroelectric power, including the Snowy Hydro Scheme and energy and water utilities. Water and food legislation were represented by irrigation legislation in all states aside from the territories and the Commonwealth. Cross-sectoral legislation was seen in Queensland, SA and Tasmania concerning integrated planning and resource management. Environmental legislation was seen in all states. Victoria was the first state to introduce environmental legislation in 1970.

Table 8.12: First EWF legislation enacted

JURISDICTION		SINGLE SECTOR LEGISLATION			MIXED SECTOR LEGISLATION				
	Self-government	**Energy (Mining & non-Mining)**	**Water**	**Food (Agriculture)**	**Energy-Water**	**Energy-Food**	**Water-Food**	**Energy-Water-Food**	**Environment**
COM	1901	Snowy Mountains Hydro-Electric Power Act 1949 (ALP) Liquid Fuel Emergency Act 1984 (ALP)	River Murray Agreement 1915 (ALP)	Food Standards Australia New Zealand Act 1991 (ALP)	Snowy Mountains Hydro-Electric Power Act 1949 (ALP)				Environment Protection (Impact of Proposals) Act 1974 (ALP)
NSW	1856	Mining Act 1874 (MIN) Gas Act 1912 (ALP) Gas & Electricity Act 1932 (ALP)	Metropolitan Water & Sewerage Act 1880 (MIN) Water Rights Act 1896 (MIN) Water Act 1912 (ALP)	Food Act 1989 (LIB)	Energy & Utilities Administration Act 1987 (ALP)		Irrigation Act 1912 (ALP)		Environmental Planning & Assessment Act 1979 (ALP)
VIC	1855	Mines Act 1890 LIB) Electric Light & Power Act 1896 (LIB)	Water Conservation & Distribution Act 1881 (MIN) Water Act 1890 (CON)	Pure Food Act 1905 (REF) Foodstuffs & Commodities Act 1914 (LIB) Food Act 1984 (ALP)			Irrigation Act 1886 (CON)		Environment Protection Act 1970 (LIBC)
QLD	1859	Mining Act 1898 (ALP) Electric Light & Power Act 1896 (MIN)	Water Authorities Act 1891 (MIN) Rights in Conservation & Utilisation of Water Act 1910 (MIN) Water Act 1926 (ALP)	Food Production (Safety) Act 2000 (ALP)	Water Power Act 1922 (ALP)		Irrigation Act 1922 (ALP)	Integrated Planning Act 1997 (NAT)	Environmental Protection Act 1994 (ALP)
SA	1856	Mining Act 1893 (CON) Electricity Act 1943 (LCL)	Water Conservation Act 1886 (MIN)	Food & Drugs Act 1890 (MIN)			Irrigation Act 1922 (LIB)	Natural Resources Management Act 2004 (ALP)	Environmental Protection Act 1993 (ALP)

JURISDICTION		SINGLE SECTOR LEGISLATION			MIXED SECTOR LEGISLATION			
			Control of Waters Act 1919 (LIB)	Food Act 1985 (ALP)				
TAS	1856	Mining Act 1912 (LIB) Hydro-Electric Commission Act 1929 (NAT)	Hydro-Electric Commission Act 1929 (NAT) Water Act 1957 (ALP)	Food Act 1998 (LIB)	Hydro-Electric Commission Act 1929 (NAT)	Irrigation Clauses Act 1973 (ALP)	Resource Management & Planning System 1993 (LIB)	Environmental Management & Pollution Control Act 1994 (EMPCA) (LIB)
WA	1890	Mining Act 1904 (ALP) Electric Light & Power Agreement 1913 (ALP)	Metropolitan Water Works Act 1896 (FOR)	Foodstuffs Commission Act 1914 (LIB) Food Act 2006 (ALP)		Rights in Water & Irrigation Act 1914 (ALP)		Conservation & Land Management Act 1984 (ALP) Environment Protection Act 1986 (ALP)
NT	1978	National Gas (Northern Territory) Act 2014 (LIB)	Water Supplies Development Act 1987 (CLIB)	Food Act 2016				Environmental Assessment Act 1994 (CLIB)
ACT	1988	National Electricity (SA) Act 1996 (LIB)	Water Resources Act 1998 (LIB)	Food Act 2001 (ALP	Energy & Water Act 1988 (before self-government)			Land (Planning & Environment) Act 1991 (ALP) Environment Protection Act 1997 (LIB)

Source: Author's compilation from data sources listed in Appendix D

8.2.2 EWF legislation: 1970 to the present

After 1970, federal legislation was seen in the energy (electricity and gas) and water domains, typically state matters. The increase in Commonwealth legislation reflected the level of centralisation and the expansion of the scope of the federal government. In the same period, environmental legislation also rose, reflecting rising environmental awareness. At the state level, new water legislation was enacted, amending much of the earlier water acts of the previous period. Electricity and gas laws developed to support the National Electricity Market were implemented at the state level. Furthermore, a number of states also enacted food legislation tied to food quality standards and regulation.

From 1970 to the present, there has been a large amount of EWF-related legislation enacted by the states, however predominantly in relation to energy and water matters. In all states, environmental legislation has been enacted, including specific climate change legislation in Victoria, Tasmania and the ACT.

Relevant energy legislation included support for energy sector reforms, such as the state implementing legislation based on Commonwealth legislation. Energy legislation included electricity industry, gas industry and mining industry legislation. New pieces of water legislation were enacted in all states, largely reflecting changes to water governance linked with water reforms, providing for changes in water rights. New River Murray and Murray-Darling Basin legislation were enacted in basin states, and other acts included catchment management acts. Food-related legislation was limited mostly to state food legislation which was enacted following national agreements in food legislation and standards. While it is acknowledged that a number of agriculture sector legislation may have been enacted, these laws are considered to be too specific as they deal with specific rural products and hence are excluded from the analysis.

From 2000 until the present, there have been fewer acts than the previous period from 1970 to 1999. Energy-related legislation included electricity and gas industry acts and water-related legislation included water management and water resources acts, similar to the previous period. There were also fewer food-related acts during the period.

8.2.3 Commonwealth and state legislation

Commonwealth

A number of laws have been enacted in EWF areas, including national electricity. Cross-sectoral legislation included Snowy Mountains Hydro legislation, first in 1949, covering both electricity, water and to an extent food (irrigation), and environmental legislation from the 1970s with scope across EWF-related areas.

In legislation, linkages between EWF were less prominent, indicating mostly siloed and sector-specific legislation. It is also difficult to compare EWF-related legislation as these are distinct from each other and focussed on covering sector-specific aspects where linkages between EWF are not easily identifiable.

One important piece of current legislation that does account for inter-sectoral linkages is the Environment Protection and Biodiversity Conservation Act 1999 (EPBC). In June 2013, the act was amended to give power to the 'water trigger' to assist in the regulation of coal seam gas and large coal mining development impacts on water resources, recognising the national significance of water resources (Department of the Environment and Energy 2018e). The water trigger is an important feature of the environmental act which requires federal-level assessment of the impacts of coal seam gas and large coal mining developments on water resources. While important, it does not cover all potential energy-sector developments that may also impact water resources and hence its coverage over potential energy-sector developments and impacts on water is narrow.

New South Wales

New South Wales showed some integration. Regarding references to other EWF sectors, local government acts as mentioned, specified powers and responsibilities of local councils concerning electricity, gas, water, sewerage and food.

Mining acts covered water use for mining rights holders which were different to water rights specified in water acts. Mining acts provided for the protection of water sources and agricultural land.

The Water Act 1912 introduced water rights for agricultural users but did not mention water rights for power generation, other farming related water acts include the Irrigation Act 1912 and the Far Water Supplies Act 1946. The Water Management Act 2000 included provisions for both irrigation, agricultural water use as well as use by electricity generators, mining and mineral exploration.

From the 1970s, only a few pieces of energy legislation included references to other sectors, and mostly related to the water sector due to their similarities as utilities (e.g. Energy and Utilities Administration Act 1987, Essential Services Act 1988). The Gas Supply Act 1996 did not have provisions for water or agriculture. The Food Act 2003 referenced water in the provision for regulations to be made for approving sources of water.

Legislation in NSW appeared mostly siloed. In the period from 1970 to 1999, the most integration was seen in energy sector legislation, although this was limited to connections with water and mostly regarding water savings and technologies. From 2000 onwards, integration was evident in water legislation, accounting for both agricultural and energy users.

Victoria

Several of the acts had cross-sectoral references. The Electric Light and Power Act 1928 covered the protection of water and gas, steam and other pipes in carrying out works. The Soil Conservation and Land Utilization Act 1947 established the Land Utilization Advisory Council providing for the cooperation and coordination of representatives of Agriculture, Forests, Lands and State Rivers and Water Supply Commissions to discuss land usage (ABS 1949). The Soil Conservation (Water Resources) Act 1965 authorised the Soil Conservation Authority to advise and assist landholders with regard to the development and use of water resources (ABS 1949). The Pipelines Act 1967 required the approval of water authorities concerning the construction of pipeline works to ensure construction would not impact the use of water and would not cause pollution (*Pipelines Act* 1967). The Groundwater Act 1969 established the Groundwater Advisory Committee in which the representatives of mines, the State Rivers and Water Supply Commission and agriculture were to be involved. While the Water Act 1905 specified water rights for irrigation, there was no reference to water in the context of energy and water for mining as this was covered in mining acts such as the Mining Development Act 1896.

From 1970 to the present, legislation reflected limited integration between EWF. Energy legislation, for example, the Electricity Industry Act 1993, had some references to water while minor references to water were made in the Gas Industry Act 1994. Neither acts mentioned agriculture or food legislation.

Water legislation demonstrated the most consideration to other energy and food-related aspects. For example, the Water Act 1989 promoted integrated management and covered matters of agricultural water use, water rights of the State Electricity Commission while the Catchment and Land Protection Act 1994 provided for the regulation of extractive industries.

Queensland

EWF legislation reflected to a substantial extent integration between EWF. Water-related legislation, in particular, reflected integration between EWF. For example, the Irrigation Act 1922 and the Water Power Act 1922 covered the generation of electricity and water power and the Rights in Conservation and Utilisation of Water Act 1910 covered water rights for agriculture, irrigation and electric power. Mining water and the protection of water from mining pollution similar to other states were covered in the mining acts.

While the Land and Water Resources Development Act 1943 covered irrigation, there was no mention of energy-related aspects. While the Water Resources Act 1989, however, made little mention of energy-related aspects, the Water Act 2000 mentioned agriculture (irrigation), mining and electricity, particularly in the context of water supply emergencies and the provisions of water to electricity generators.

The Petroleum and Gas Act 2004 referenced water throughout the legislation with major sections concerning water rights and water monitoring authorities. The state furthermore enacted the Integrated Planning Act 1997, which although did not target EWF sectors, provided broad principles for dealing with EWF in an integrated manner.

South Australia

Mining acts provided for regulation to prevent water pollution from mining operations. Water legislation (the Water Resources Act 1990 and the Water Resources Act 1997) referenced irrigation but made no mention of energy-related aspects. One feature of the Water Resources Act 1990 was the establishment of the SA Water Resources Council which under legislation brought together representatives of the Engineering and Water Supply Department, the Department of Lands, Department of Agriculture, Department of Environment and Planning and the Department of Mines and Energy. Such membership arrangements represented the integration of decision-makers, with representatives from each EWF sector. While the Water Resources Act 1997 also legislated for the establishment of a new Water Resources Council, membership differed from that of the previous legislation with requirements only for a representative with knowledge of and experience in the use or development of water resources for primary production

The Natural Resource Management Act 2004 provided for the integrated management of the state's resources and the protection of water and land resources and covered various issues relating to rights to water and the regulation of activity affecting water. The act also referred to both agriculture and mining and their contribution to the economy, recognising the importance of water management to support the sectors.

Tasmania

There were various instances of integration in EWF legislation in Tasmania, including cross-sectoral legislation for hydropower. Mining legislation similarly provided for water licences for mining.

The Water Act 1957 took into account food linkages (agriculture) and electricity linkages (water rights for electricity purposes). In the establishment of the Rivers and Water Supply Commission, the Act specified the need for an agricultural member as part of the Commission to advise on aspects relevant 'in particular to the increase of food production'(*Water Act* 1957, s. 4.2c). The Electricity Supply Industry Act 1995, although covering electricity and water, made little reference to agricultural-related. Water management acts however considered electricity but also took into account irrigation activity.

Western Australia

Integration between EWF was evident in a number of acts in WA. In relation to water, acts covered irrigation and agricultural water use (Rights in Water and Irrigation Act 1914, Waterways Conservation Act 1976, Water Services Act 2012) and in relation to electricity, acts covered water rights (State Electricity Commission Act 1945). No legislation reflected integration of all three sectors.

Northern Territory and Australian Capital Territory

Some integration was evident in NT legislation. The Water Act 2016, although not referring to electricity, made reference to mining and petroleum regarding their exemption from the pollution regulation. Numerous references were made to agriculture and irrigation, both being recognised as users of water. The Pastoral Act 2011 however also referred to electricity and water.

The integration of energy and water was most prominent in ACT legislation, as seen in the Energy and Water Act 1988, the Electricity and Water Act 1988 and the Utilities Act 2000. Energy and water legislation provide for the provision of electricity, gas, water supply and sewerage services. There was no mention, however, of food or agriculture

An important relationship between legislation and organisations during this period was related to the constitution of Boards for statutory authorities of which under legislation, certain members were to be appointed. For example, under the Victoria's Groundwater Act 1969, a Groundwater Advisory Committee was formed, and under such legislation, members were to include not only specific water-sector representatives such as the State Rivers and Water Supply Commission but also the Secretary for Mines as chairman and the Director of Agriculture. Hence legislation brought together representatives of mines, water and agriculture sectors to advise upon groundwater usage and development. Under Tasmania's Water Act 1957, one of three members appointed to the River Water Supply Commission was to include 'a person who is considered by the Governor competent to advise the Commission on the relation of its operation to the general economy of the state and in particular the increase of food production' who was to be called the Agricultural member (*Water Act* 1957, s. 4). In this arrangement, water and food representatives were brought together to make decisions regarding Tasmania's river and water development.

Similarly, in SA, the Water Resources Act 1990, in establishing the SA Water Resources Council, brought together representatives of the Engineering and Water Supply Department, the Department of Lands, Department of Agriculture, Department of Environment and Planning and the Department of Mines and Energy. In the Water Resources Act 1997, the establishment of the Water Resources Council also required the membership of a representative from primary production.

These aforementioned cases highlight the role of legislation in creating decision-making structures that consider EWF interlinkages.

Summary

During the period, each state enacted important laws regarding energy (in mines and electricity) and water. While mostly sector specific, many pieces of legislation referenced other sectors.

The above shows some integration in state legislation evident in the cross-sectoral references in sector-specific legislation. The Catchment and Land Protection Act 1994 in Victoria, the Integrated Planning Act 1998 in Queensland, and the Natural Resources Management Act 2004 in SA were the only examples of legislation reflecting the integration of EWF, exhibiting an integrated approach applicable to jointly managing EWF with provisions to consider inter-sectoral impacts. Other state legislation was mostly sector specific, particularly energy legislation.

Most water legislation took into account agriculture aspects, particularly irrigation legislation but little reference was given to energy aspects aside from Tasmanian legislation, where water legislation remained closely tied with electricity. This distinction between Tasmanian and other state legislation, however, reflected the physical energy and water linkages of the state's hydropower, making the states' joint water and electricity legislation historically unique compared to the other states.

8.3 Pricing and other sector-based constraints

This section focusses on Level 4 institutions that guide the conduct and operations of EWF sectors. As with the analysis of policy and legislation, it is not in the scope of the research to cover the entire range of operational and process-related institutions, thus only a few examples are selected. Throughout the experience of EWF developments, three groups of level four institutions are notable, pricing processes and related sector arrangements in EWF, and although specific to one sector, specific water institutions related to water rights, water planning processes and environmental impact assessments and in particular, the 'water trigger'.

8.3.1 Pricing processes and market arrangements

The pricing of EWF is an important part of the institutional settings for EWF as it guides the allocation of resources, influencing consumption, production and investment decisions. Prices for EWF products and services have been subject to various pricing processes ranging from fixed, regulated pricing to market-based, competitive pricing, applied to the different stages of the supply chain in each sector.

In the early periods until the beginning of economic reform, the pricing of EWF was largely under some form of government control. In the 1970s, changes to pricing became an important part of economic reform, which as described above, emphasised market-based pricing in line with neoliberal ideology. Pricing for energy and water largely involved local and municipal governments, statutory authorities or other public authorities and currently independent regulators, whereas for food, pricing, first influenced by government, is now largely market determined. EWF pricing with respect to their various industries and product offerings has evolved over the years since the early developments, economic reforms and to the current day.

Table 8.13 provides a description of current pricing processes for EWF as well as differences between states. Each sector currently employs different pricing processes and through price linkages between EWF, the price of one resource influences the price of other resources.

Table 8.13: Pricing for EWF

	Price Types	Pricing	State Differences
Electricity and Gas Prices	• Wholesale Prices • Network Prices • Retail Prices	• Wholesale prices determined competitively based on bidding from generators in the NEM • Transmission prices are regulated determined by cost recovery and revenue caps • Retail prices are regulated determined by cost recovery and revenue caps. Some states have moved towards deregulated pricing	• Wholesale market in the NEM and WA is operated by AEMO • Transmission and Distribution regulated by the AER and NEM and in NT and by the ERA in WA • Retail prices competitive in Victoria, SA, NSW and South East Queensland • Retail prices regulated in Tasmania, Act and Rural Queensland
Water Prices	• Rural Water Prices • Urban Water Prices	• Both rural and urban water prices are regulated • Expected to follow the National Water Initiative Pricing Principles • Urban pricing promotes consumption-based pricing through two-part tariff and block pricing • Sewerage pricing based on property rates	• Majority of utilities in the each state use two-part pricing. • In ACT, QLD, SA, BIC, WA, pricing also includes 2 to 3 step block pricing • QLD Townsville water pricing is through standard plana

	Price Types	Pricing	State Differences
Food Price	• Farm gate price • Factory gate price • Wholesale price • Back of Store Price • Retail Price • Import Price • Exported price •	• Subject to competitive influences across the supply chain. • Intensity of competition varies across • Supermarkets are influential and can provide stability	• Market-based pricing in food

Sources: a. Crase, Pawley & Cooper, 2015, p. 21

Integration of EWF

The analysis of EWF pricing shows that despite changes in EWF pricing from fixed and government-involved processes to the current market-based pricing with some regulated pricing in energy and water network services, there has been no evidence of integration of EWF in EWF pricing, and no special consideration of the relationship between EWF. Pricing processes appear to be primarily concerned with the costs and pricing of the specific sector with no consideration of externalities or impacts on or scarcity of resources (beyond potentially high pricing signals). Pricing processes have not reflected the true costs of consuming EWF and furthermore risk encouraging sub-optimal behaviour (use, production and consumption).

During the period of government-controlled pricing, for example, subsidies such as water subsidies and the fixed pricing of agricultural products promoted the exploitation of water in the agricultural sector which eventually led to water scarcity issues. While there were opportunities to regulate the consumption and use of EWF to ensure security and conservation, the development goals of the period, however, encouraged the exploitation of resources. According to Parker and Speed (2010), government control of water was to encourage water use and manage water users rather than regulate the consumption of water for sustainable use.

Electricity pricing was also regulated but based on property rates and ensuring investment returns, neither with special consideration of the impacts on water. In the 1970s, the Commonwealth took part in regulating oil pricing to import parity levels.

Fixed pricing of food as part of the government's marketing schemes involved guaranteed pricing which as mentioned, sought to protect farmers' welfare. Through pricing schemes determined on the basis of cost of production indexes, farmers' incomes were protected against any external shock and despite any possible inefficiencies in production. There were no incentives to conserve water or energy.

As market-based pricing, exposure to market forces and external volatility and competition were introduced to the agricultural sector to improve efficiencies, there was less opportunity to consider

EWF interactions in pricing processes, given the reliance on market mechanisms to allocate resources to higher valued needs. Market–based pricing processes have fallen short of considering the interrelated impacts of EWF, one primary reason being because the impacts resulting from EWF interlinkages are considered as externalities and are not reflected in market-based pricing.

While the transition towards market-based pricing (seen to improve resource use through exposure to competition) may have encouraged farmers to make better use of their resources such as land and water and energy needs, the inability to consider externalities, particularly in relation to EWF and security, renders current pricing inadequate and unsuitable.

For example, water pricing principles of the NWI do not have any special consideration regarding energy and food aspects. Failure to properly define and account for externalities and the value of water as a critical need were criticisms of NWI pricing principles (Department of the Environment, Water, Heritage and the Arts [DEWHA] 2010). Water pricing principles regarding two-part pricing for consumption-based pricing have also been introduced so that users can account for their water use. Such pricing similarly does not account for externalities. Water pricing is also based on cost recovery in order to ensure return on investment and to further attract investment.

Competitive pricing system of the National Electricity Market's wholesale electricity generation also does not consider the impacts of electricity generation on EWF. Electricity generation is organised based on selecting the lowest cost generators to generate electricity, regardless of the impacts of their generation (AER 2017b, p. 24). Generators are selected based on the cheapest bids with no consideration to the impacts of generation for example, whether or not such generation might result in the high consumption of water or pollution. It neither considers how the electricity is generated and whether this will have negative impacts.

Furthermore, retail and network prices are based on the cost recovery of capital expenditure and inputs, neither accounting for water, food or environmental externalities. The cost-benefit analysis used in regulatory investment tests may not take into account the impacts of the investments on the use of water or land and food resources. Energy pricing, however, does not account specifically for water and food costs or the externalities associated with the impacts of energy production or use on water and food resources or securities. Food pricing is mostly market-determined with no obligation to account for energy and water impacts in the way food is priced.

Current pricing processes emphasise cost-recovery and EWF are considered as ordinary inputs. There is no consideration of EWF interlinkages and no specific mention of EWF as special components. Nor is security captured, for example, in terms of ensuring affordability or accounting for externalities that may impact EWF security.

There was no mention of the cost of security-related externalities in pricing processes. The impacts of water use and energy use in terms of security, scarcity and externalities, however, were not covered in the pricing of water and energy themselves. This may suggest that water and energy are likely priced under their actual costs.

Prices have been based on sector-specific characteristics and have not taken into account other costs related to impacts on other sectors. However, this may be expected with deregulated pricing as competitive pricing does not typically consider such impacts on EWF securities.

8.3.2 Specific water institutions

In the context of Australia, water is a key input and its potential scarcity, characteristic of Australia's geography, is such that properly managing water resources is essential and vital. The dependency of food on water from production, processing to food preparation in both industry and households, and the dependency of energy on water from production to household use, across the entire supply chain means that there is an important role for specific instruments or processes to manage water use.

Non-economic mechanisms such as water bans and restrictions have played a role in the past during drought periods to impose water conservation and reduced water consumption. As seen in recent periods, economic mechanisms have also been the focus of water management to transition towards consumption-based pricing and markets for water rights, allocation and entitlements. Markets have sought to move water to higher-valued uses, underpinned by principles of efficiency through the trade of allocations and entitlements. The issue, however, is that such principles may not provide for the allocation of water that is required to ensure long-term food security. This is discussed by Kiem (2013) who stated that it is difficult to determine whether agriculture is a high-value user and thus with market-based instruments, water is likely to be shifted away towards mining and manufacturing, considered as high valued users, away from agriculture. As the author states, this also has implications for the climate change policy, in that the greater security of water for mining and manufacturing continues to facilitate industries that produce emissions. The important point to be made however is that market-based instruments inadvertently prioritise water security for energy over water security for food, creating trade-offs. The commoditisation of water further enables water to be held for economic gain, making it difficult to utilise or leave water where it may have a non-economic use, for example, water for the environment or water for spiritual purposes.

While the NWI focussed on water rights (allocation, entitlements, trading), it also introduced the requirement of statutory water planning for states for which water sharing plans were to be developed. Although important for the purposes of long-term water planning and allocation, the

guidelines developed by the NWI do not necessarily provide guidance to specifically ensure water security, which is left to decisions made by the states. There is only acknowledgement of the mining industry.

It is apparent that the conditions for water use between water users are inconsistent. For example, farmers and miners have been subject to different water rights, where the rights of miners to water has been protected in mining legislation, developed in the nineteenth century and that of others has been provided for in other water acts. Special provisions that held the rights to water by miners were not subject to the regulations of water acts. Currently, there is still a disparity between the water usage governed in the farming industries and that governed in the extractive resource industry, with little integration between the two (PC 2017a). It is a criticism of the NWI that such separation continues to exist, despite originating in early mining and water legislation from the previous century.

In relation to water protection, the development of the 'water trigger' as part of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) has been an important mechanism for protecting water from energy production-related impacts by imposing the necessary assessments on water impacts. However, as discussed in previous sections, the scope of activities for which the water trigger applies and is imposed is narrow, this being only coal seam gas and large coal mining development.

Summary

The above section discussed Level 4 institutions associated with the operation of sectors including pricing processes, related market arrangements and specific water institutions that have been developed to support improved water management. Both were discussed in the context of whether such reflect integration or separation between EWF.

The analysis of pricing shows that pricing schemes are largely sector specific, emphasising cost-recovery principles and do not account for externalities, particularly those associated with the impacts on EWF securities. Deregulated and competitive pricing furthermore, limits opportunities for these externalities to be incorporated, and this is because of the potential price distortions that may prevent fully competitive pricing which the economic reforms of the previous decades sought to achieve. EWF are part of ordinary input costs. Furthermore, the impacts of EWF production and consumption on EWF securities are not accounted for. Regulated pricing in the water sector and the energy transmission networks could be a means for incorporating externalities, but this is not likely as it could cause distortions as such pricing is only applied to certain stages of the supply chain.

The analysis of specific water institutions also shows limited integration and instead highlighted the potential biases inherent in water institutions that may favour energy sector water uses (higher value uses) over agriculture and food sector water uses (lower value uses).

This analysis shows at the last level of institutions, despite instances of integration at high institutional levels, for example, at the portfolio, ministerial, organisational, policy and legislation level, there is greater siloedness and separation between EWF. The linkages between EWF have become less accounted for, further down the levels.

8.4 Conclusions

This chapter focussed on policy, legislation, pricing and other sector arrangements that influence EWF sectors to identify the extent to which there has been integration between EWF to determine whether a nexus-based approach is evident or whether such reflects a siloed approach for dealing with EWF matters. The chapter was broken down into the respective parts, policy, legislation and pricing and other sector arrangements, representing both Level 3 and Level 4 institutions. The main points are as follows:

- The analysis of EWF policies, as well as some of the broader economic and environmental policies, show some integration of EWF as often policies refer to other sectors, including the importance of linkages. Such references to linkages included the importance of water security for agriculture, which was also an important consideration and constraint regarding the development of unconventional gas (reflecting EWF linkages), and the role of both water and agricultural sectors to improve energy efficiency and hence reduce emissions, particularly relevant for the agricultural sector. Most references to other sectors, however, were often very minor.
- No policies appeared to reflect a fully integrated EWF policy approach and most policies regarding EWF were sector specific. Broader economic and environmental policies were those that had scope over EWF. At the state level, policies for EWF were tied to broader economic and environmental objectives. While agricultural and energy sector policies sought to pursue growth objectives, water policies have become increasingly important to support such goals and to govern and manage water use between users from both agriculture and energy sectors. The importance of water policy is also reflected in water legislation.
- The analysis of legislation and the regulatory dimensions of EWF also revealed little connection between EWF. Legislation tended to be mostly sector specific, dealing with sector-specific details and issues. Links between EWF were less obvious. Environmental legislation such as the Natural Resource Management Act 2004 in SA was important in considering EWF linkages in the context of natural resource protection. The ‘water trigger’, a feature of the

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), was an important development reflecting important considerations for energy production and use-related impacts on water resources and the indirect impacts such would have on land and thus agriculture. This demonstrates the role environmental legislation has in regulating the negative impacts of energy, water and land resource use on the resources themselves.

- The analysis of the pricing processes showed almost no integration between EWF with no provisions for incorporating externalities associated with the impacts of EWF resource use or impacts on EWF security. During periods of fixed pricing, it was not clear whether inter-sectoral linkages were taken into account. Priorities for pricing were mostly associated with cost-recovery principles.
- The lack of integration between EWF evident in both Level 3 and Level 4 could be correlated with the lack of integration inherent in the higher institutional levels (portfolio, ministerial and organisational levels). However, this did not entirely explain integration at the policy level. For example, while portfolio, ministerial responsibilities and organisations were largely separate during the Gillard Labor government, policies at the time appeared to consider EWF linkages, although no policy was fully integrated and policies were essentially still sector-based.
- In general, there was no evidence of a fully integrated and comprehensive EWF policy. There was no evidence of any longstanding integration of EWF at the portfolio, ministerial and organisational level. Separation was more apparent than integration at such a level.
- The extent of integration continues to reflect physical EWF linkages, particularly water and food linkages that have originated since early development. As challenges such as climate change and population growth make interlinkages between EWF more apparent, it will be increasingly important to deal with EWF from an integrated nexus approach. The analysis in this chapter and in the previous chapter shows that policies, legislation, pricing and the decision structures underpinning them are mostly siloed.

The objective of the next chapter is to recommend ways to overcome these issues, ways that are both practical as well as socially and politically acceptable. The next chapter also provides an analysis of the all institutional levels considered together.

Chapter 9 Synthesis and recommendations

The previous chapters (Chapter 5 to 8) presented the findings of the application of the *Levels of Institutional Analysis* framework, developed in Chapter 4, to examine Australia's experience in governing EWF matters from the late 1700s to the present.

This chapter comprises three sections. Section 9.1 provides a synthesis of the findings of the previous chapters, with an emphasis on understanding the relationships between the themes explored in the separate chapters over the five main periods. Section 9.2 develops a set of recommendations to suggest ways in which institutions could evolve to incorporate a more nexus-oriented approach for governing EWF to better deal with EWF issues, more importantly, EWF security challenges. Section 9.3 concludes.

9.1 Synthesis of findings

Chapter 5 analysed, for each period, the main developments in broader socio-economic and political contexts and in EWF domains. The analysis suggested that there was a major change in Australian socio-economic and political development, from a path of development characterised by high levels of government involvement in the early years, to a path of development characterised by an emphasis on markets and neoliberalism, both impacting and shaping the EWF sectors.

Chapters 6 to 8 discussed the Levels of Institutional Analysis on EWF institutions at the Commonwealth and state levels, focussing on the relationships between EWF domains and between institutional levels. This analysis comprised three parts. The first part looked at development philosophies and the second, the levels of government involvement (Chapter 6). The third part assessed the extent to which an integrated approach for dealing with EWF was evident in policy-making structures and the ensuing policies and rules (Chapters 7 and 8).

The following discussion synthesises the main findings of Chapters 5 to 8.[21][22]

[21] The political parties analysed have been grouped into two: Labor and non-Labor parties. This borrows from classification used in Moon and Sharman (2003). The grouping is used simply to ease the exposition of political settings, given the diverse range of political parties that have existed over Australia's history.

[22] This chapter reproduces some already material presented. This is done with the view to preclude the need to have to repeatedly refer back to previous discussion to support flow of this chapter.

9.1.1 EWF developments in Australia

Chapter 5 provided a historical overview of EWF developments in Australia across the five formative stages of Australia's development. The overview suggested that since the late 1700s, EWF sectors have evolved substantially. The first period, representing colonial development, followed by self-government by states, was characterised by early developments in agriculture and mining as key economic sectors, and decentralised electricity systems and water services in line with early urbanisation. Land and mining legislation, comprising land licences, leases and grants, sought to organise land use for agricultural and mining in line with the development of the sectors. The prosperity of agriculture and mining attracted a number of migrants, contributing to population growth. The 1880s were times of drought and water scarcity; this prompted the development of irrigation and, importantly, called for government involvement to redefine rights to water which had been based on private riparian rights, to better manage water use. The war years caused economic depression and posed challenges to economic growth, affecting export industries such as agriculture. Protectionist measures were introduced and state government assistance became the norm. Across the states, large state authorities were established in the electricity and water sectors, replacing smaller local governments and private entities, reflecting a trend towards centralisation and nationalisation. After World War II, a number of state authorities were established to control the marketing of agricultural products. The post-war years until the 1970s were times of increasing government involvement in driving development.

The last two periods, from the 1970s to the present, reflected a significant change in the path of economic and social development, away from governments towards markets (deregulation, privatisation, competition). All sectors including EWF were subjected to reform. Energy reforms included corporatisation, the break-up of state authorities and restructuring. The water sector reforms included pricing, water rights and trading systems, development of a water market, and strategies to address environmental issues such as salinity. The food sector reforms involved a reduction of protectionist measures, the dismantling of state authorities that controlled the marketing of agricultural products, and a shift towards competitive markets. These years also resulted in the greater involvement of the Commonwealth government through national policymaking. Growing intergovernmental cooperation, seen in the establishment of the Council of Australian Governments (COAG), thus became an increasingly important feature of the government's approach to address EWF issues, particularly cross-boundary issues such as the Murray-Darling Basin and the National Electricity Market. Environmental issues also became increasingly important, seen in the development of Ecologically Sustainable Development principles and efforts to reduce emissions and address global warming.

The current challenges facing Australia include the energy security concerns of reliability, affordability, climate change policy, reoccurring water scarcity issues such as drought, affecting food production and the livelihoods of farmers, calling into question the viability of agriculture. Further, these challenges are interrelated. For example, proposals for unconventional gas meant to improve energy security could pose threats to agricultural land and food production through environmental impacts on land. Both energy and food sectors' requirements for water will also place a strain on current water resources.

Confronting these challenges will require effective policies and strategies supported by appropriate institutional structures that need to focus not only on sector-specific but also cross-sectoral issues. The current institutional structures are more focussed on addressing sectoral issues, and only marginally, cross-sectoral (as discussed earlier).

9.1.2 Evolution of EWF nexus

In Australia, interlinkages and interdependencies between EWF have evolved in tandem with changes in the physical environment and human needs. Since colonial times, land and natural resources have been exploited; in earlier years, to develop the colonies and meet British interests, and later, to develop the national economy. The development of the rural sector and urban areas had placed considerable demands on water for agricultural expansion and the development of towns and cities with strong linkages between food production and water since the beginning of Australia's modern development. Water for mining linkages also formed as the mining sector too became an important contributor to exports. In Tasmania, for example, given its abundant water resources, linkages between electricity and water were formed through hydroelectricity development. Historically, water has been a central component of Australia's EWF nexus (with the country's development hinging upon its ability to govern water). Energy and food linkages, although less prominent, have been associated with energy inputs in farming, agricultural production and the transportation of food, and land use by agricultural and energy-related sectors (e.g. mining) and more recently, for gas exploration.

The nature of EWF linkages is not easy to describe and go beyond two-way physical linkages, (as discussed), for example, how linkages between water for food production may impact on energy production.

The institutional dimensions of the EWF nexus represent the way in which EWF sectors are governed. The physical EWF linkages are reflected in the institutions that have governed them, influenced by the broader economic, social and environmental priorities and agenda. The degree to which EWF have been governed jointly has varied across the five time periods and states. This

section considers all institutional levels and how they have varied across the five periods, shaping EWF linkages.

Period 1: Early settlement and colonial development (late 1700s to 1900)

The development of EWF sectors during this period was driven by colonial development, characterised by the exploitation of land and natural resources to support the domestic population and British interests. The abundance of land and the discovery of natural resources enabled the development of primary industries in mining, pastoralism and agriculture. Described as 'colonial socialism' (Butlin, Barnard & Pincus 1982), the colonial governments played a crucial role in supporting the cultivation of crops and the raising of livestock through the establishment of agricultural colleges and experimental farms and the exploration of minerals through financial and technical assistance. The regulation of land through land legislation, licenses and grants shaped the development of these primary sectors, which soon became important export sectors contributing to economic growth. The development of industries, such as electricity and gas and water services (supply, sewerage and drainage) were in line with the development of towns and cities and the growth of other industries and were facilitated by local governments, regional authorities and private enterprises. The development of these sectors reflected their importance in the formation of early colonies and their economic and social development. In meeting these growth objectives, the development of EWF sectors were intertwined forming the early linkages between EWF.

Energy and water

Mining, electricity and gas and water (supply, drainage, irrigation) were important matters in each state. Water was an important input in the mining process while mining processes also impacted water resources. Early mining legislation in the states provided for the use of water as well as the construction and operation of water infrastructure by mining rights holders. Mining rights to water, however, were separate from those specified in water legislation for other water users, hence providing special water privileges to the mining industry. In Victoria, for example, mining and water were the combined responsibility of ministers in 1880 and in the 1890s. At the same time, the Department of Mines and Water Supply was established with the primary responsibility for mining and groundwater (Public Record Office Victoria 2017a). Electricity and water supply were the responsibilities of local councils. Local councils determined electricity and water rates based on property rates, allowing for the recovery of costs in investing, constructing and developing such systems. In Tasmania, the development of hydroelectricity began during this period, initially with a small station constructed by the Launceston City Council (ABS 1949).

Energy and food

Mining and agriculture were important colonial matters due to their economic significance; both were therefore supported by state government assistance and both relied on land and water resources. The creation of mining and agricultural portfolios in the late 1800s reflected their importance. In New South Wales, a combined portfolio for mining and agriculture was created in 1890 and was the responsibility of the Secretary of Mining and Agriculture until 1907, also supported by a corresponding state government department, the Department for Mines and Agriculture. In Victoria, mines and agriculture was also a combined portfolio under the responsibility of one minister (1883-1886).

Water and food

Water played an important role in promoting agriculture. The importance of water became evident when the droughts in the late 1880s threatened the prospects for further agricultural development. The control of water resources by the government and limits to private riparian rights was legislated in water and irrigation acts as a means of overcoming and adapting to highly variable water resources. It especially provided the setting for the government control of water, which continued into the following periods.

Efforts to develop irrigation commenced in the late 1880s, reflecting the importance of water management for agricultural purposes, food production and rural expansion. In Victoria, the need to jointly govern water and food was reflected in the integration of water and agricultural responsibilities at the ministerial level. This was evident with the appointment of the Minister of Public Works, Agriculture and Water Supply (1881), and with a minister responsible for both the agriculture and water portfolios (1892). However, there was no corresponding department that was responsible for both water and food matters. Victoria was also the first state to enact the Irrigation Act in 1886.

Energy, water and food

The early development of mining, agriculture, irrigation, electricity, gas and water (supply, sewerage and drainage) took place before federation to meet colonial development objectives. EWF responsibilities were shared between state and local governments. State governments were responsible for mining and agricultural matters as well as water matters such as water infrastructure, shared with local governments. Local governments, through local government laws, were responsible for electric power, lighting, water services, abattoirs, marketplaces and the sale of food (ABS 1908). Following ministerial titles and government departments, the integration of responsibilities at the ministerial level and department level was limited to only two sectors (either energy and water, energy and food, and water and food) and not to all three sectors.

Otherwise, sector responsibilities were subsumed under the responsibilities of other ministers with broader responsibilities, such as those responsible for lands and works portfolios.

Integration by jurisdiction

The state ministries during the first years of self-government were small and ministerial responsibilities involved mining, agriculture and broader portfolios such as land, works or public works, which were likely to entail EWF-related state responsibilities where no specific portfolio was created. The integration of EWF responsibilities at the ministerial and department levels was perhaps the result of smaller ministries and few departments where EWF responsibilities were combined.

Only NSW and Victoria showed examples of integrated responsibilities during colonial times, during the Protectionist government in NSW and the Ministerialist, Conservative and Liberal governments in Victoria. Table 9.1 lists the political parties in power and Table 9.2 details the minimal integration in the country, only evident in NSW and Victoria and both under early non-Labor governments.

Table 9.1: Political parties in power (1800s to 1900)

Jurisdiction	COM	NSW	VIC	QLD	SA	TAS	WA
Political Party	-	Free Trade Protectionists	Ministerialists Conservatives Liberal	Ministerialists Labor	Ministerialist Conservatives Liberal	Ministerialists	Independents

Source: Australian Politics and Elections Database, University of Western Australia 2018

Table 9.2: Years served under a minister and government department responsible for more than one sector (1800s to 1900)

Jurisdiction	Minister						Government Department					
	Years	% of period	EW	EF	WF	EWF	Years	% of period	EW	EF	WF	EWF
COM	-	-					-	-				
NSW	11 (45)*	24%		✓			10	22%		✓		
VIC	15 (45)*	33%	✓	✓	✓		6	13%	✓			
QLD	-	-					-	-				
SA	-	-					-	-				
TAS	-	-					-	-				
WA	-	-					-	-				

*Years in brackets shows year in power since self-government

Source: Author's compilation from analysis in Appendix I

Period 2: Federation, World War I and the Great Depression (1901 to 1938)

EWF sectors continued to play an important role in this period, contributing to the nation-building objectives of post-federation times. The establishment of the Commonwealth government introduced a central government which, although did not have direct power over EWF, had the power to influence their development through its role in trade and external affairs, through its financial dominance and in its responsibilities to coordinate states and to ensure living standards across the country. Coordination was particularly important in areas of water sharing seen in the conflict between NSW, Victoria, and South Australia over River Murray, leading to the River Murray Act in 1915.

One of the features of this period was the centralisation of electricity supply and water as evident in the establishment of large state electricity commissions, regional water boards and state water commissions. Many of these water commissions, responsible for rural water supply, also became responsible for irrigation matters.

Continued emphasis on rural sectors, especially during war-time, saw greater involvement by governments and resulted in the creation (like in energy and water sectors) of large state authorities such as statutory marketing boards, including the Australian Wheat Board. Assistance to farmers and soldier settlement schemes (to settle ex-servicemen on farms) were, as mentioned, a means for supporting the agricultural sector. Emphasis on continued agricultural and mining developments implied greater water requirements.

Energy and water

Energy and water were the primary responsibility of the state governments and across the states, and energy and water linkages included those between mining and water, and electricity and water.

As the mining sector developed, linkages between mining and water remained. Mining and water, specifically groundwater, were grouped at both ministerial and department levels in Victoria for much of this period. Similar ministerial arrangements, combining mining and water portfolios, were seen in other states. This was seen in SA when the public works (water) and mining portfolios were the combined responsibility of one minister (1912-1914 and 1922) and when the mines and marine portfolios were the combined responsibility of another minister (1914-1916, and 1917); in Western Australia with the the Minister for Mines & Water Supply and Sewerage & Drainage (1914-1916), and in Tasmania, with the Minister for Works and Mines (1922).

Electricity, gas and water supply developed locally across the states, varying in both local government and private sector involvement. In 1920, for example, in NSW, the Minister for Local Government and the Department of Local Government were responsible for both water and

sewerage and electricity supply matters (NSW Government State Archives & Records 2017c), reflecting the representation of local energy and water matters at the state level. In line with the centralisation of electricity and water supply in the states, public works and local government-related portfolios, ministers and departments were responsible for dealing with electricity and waterworks, and often these were grouped with mining portfolios. In Tasmania, portfolios, ministers and organisations responsible for hydroelectricity matters from 1914 to the end of the period were in line the state's emphasis on hydroelectricity development. In Victoria, electricity and water were also managed jointly under the minister responsible for the water supply and electrical undertakings portfolios from 1935 until the end of the period.

Legislation relating to both energy and water was introduced during this period in Queensland, introducing the Water Power Act 1922, and in Tasmania with the introduction of the Hydro-Electric Commission Act in 1922. This reflected energy and water linkages associated with hydroelectric power.

Although the Commonwealth role in energy and water during this period was limited, instances of combined energy and water responsibilities were seen in the Commonwealth Department of the Interior which was responsible for encouraging oil exploration and oil investigation and for administering the River Murray Waters Act 1915.

Energy and food

Linkages between energy and food continued to evolve during this period. In SA, a minister was responsible for both the mines and agriculture portfolios (1919-1922), also responsible for the irrigation portfolio (1920-1922 and 1933) and in WA, there was a Minister for Mines and Agriculture (1924-1928). At the Commonwealth level, the Prime Minister and External Affairs Department was responsible for the administration of food-related legislation and oil legislation.

Water and food

In most states, water and food groupings were consistent with continuing rural expansion and the irrigation development. In NSW, for example, this was demonstrated with the establishment of the Water Conservation and Irrigation Commission in 1913, responsible for irrigation matters since 1913. Prior to this, the NSW Department of Public Works was responsible for irrigation, under its Irrigation and Drainage Branch (NSW Government State Archives & Records 2017c).

In Victoria, water and food portfolios were the responsibility of the Minister for Agriculture and Water Supply (1907-1917, 1921-1924); another minister was responsible for the water supply and wheat scheme portfolios (1923). The State Rivers and Water Supply Commission was also responsible for irrigation matters and rural water supply from 1906 (Public Record Office Victoria 2017b).

In Queensland, the state's only organisations with cross-sectoral responsibilities were the Lands Department with its Irrigation and Water Supply Sub-Department, and the Irrigation and Water Supply Commission. In SA, water and food responsibilities were combined at both ministerial and department levels. At the ministerial level, this was seen in ministers responsible for the agriculture, public works and irrigation portfolios. From 1905, these ministers included the Commissioner for Public Works and Agriculture (1905-1906 and 1919-1920), the Minister for Agriculture and Irrigation (1912-1915 and 1927-1930), the Minister for Irrigation from (1922-1926) and from 1930, and a minister responsible for the public works, marine and irrigation portfolios (1918). In 1923, the SA Irrigation Commission was made responsible for irrigation and in 1931, irrigation matters became the responsibility of the SA Engineering and Water Supply Department, the states' main water body (State records of South Australia 2017a, 2017b). In WA, the Minister for Goldfields and Agriculture Water Supplies was made responsible for water and food-related matters (1927-1930).

In this same period, and following Victoria, irrigation legislation was introduced in other states, in NSW (Irrigation Act, 1912), in WA (Rights in Water and Irrigation Act, 1914), and in Queensland and SA (Irrigation Act 1922 in both states). Irrigation development hence was the main driver for the integration of water and food.

Energy, water and food

Although integration between two of the three domains was evident, there were few instances of joint governance of all three EWF sectors. Some instances were evident in ministerial responsibilities. This was seen first in SA with a minister responsible for the agricultural, irrigation and mines portfolios (1920-1923) and a minister responsible for the mines and irrigation portfolios (1933). In Victoria, a minister was responsible for both agriculture and mines (also responsible for groundwater hence implying EWF responsibilities), and in Tasmania with ministers responsible for agriculture, administering the Hydro-Electric Department (1934) and works in the 1930s. Such ministers, however, were only in power for short periods, indicating no long-term integration of EWF.

Integration by jurisdiction

Integration of EWF varied during the period across the states under various governments. The period after federation was a time of frequent turnover in government and diversity of political parties that formed government. The Australian Labor Party in particular came to power in all states, rising in prominence as a major political party during this period. Table 9.3 details the political parties in power during the period.

Table 9.3: Political parties in power (1901 to 1938)

Jurisdiction	COM	NSW	VIC	QLD	SA	TAS	WA
Political Party	Protectionist Labor Free Trade Liberal Fusion National Labor Nationalist United Australia Party	Progressive Liberal Labor Nationalist United Australia Party	Reform Liberal Labor Nationalists Country United Australia Party United Country Party	Ministerialist Liberal Labor Country & Progressive Nationalist Party	Liberal Conservative Labor Liberal & Country League	Liberal Labor Nationalist	Ministerialist Labor Liberal Nationalist Coalition

Source: Australian Politics and Elections Database, University of Western Australia 2018

Across all jurisdictions, there was at least one instance of integration between two sectors, and only in SA, Victoria and Tasmania were there instances of integration of three sectors. In most states, integration occurred during both non-Labor and Labor governments. Only in Queensland and WA did integration occur only during a Labor government. Irrigation and Water Power Acts across the states were enacted during a Labor government.

Tables 9.4 and 9.5 indicate the combination of integration between sectors. At the Commonwealth level, integration was evident between energy and water and energy and food during the non-Labor, United Australia Party. In NSW, integration was seen between energy and water during both non-Labor (Nationalist and United Australia Party governments) and Labor governments. Integration of water and food was seen also during both governments as a result of little change in the organisations responsible for water and food. In Victoria, integration was seen between energy and water and water and food during both non-Labor and Labor governments, although mostly during non-Labor governments who dominated government during the period. In SA, integration was seen in all types of combinations, mostly water and food, energy and water, and energy and food as well the integration of all three. This was during both non-Labor and Labor governments although mostly during non-Labor governments which, similar to Victoria, dominated government during the period. In Tasmania, most integration was seen between energy and water, associated with hydro-electricity with some instances of integration between water and food and one instance of integration between EWF during both non-Labor and Labor governments. In WA, integration was seen between energy and water, energy and food and water and food. In Queensland, integration was seen between water and food. In both states, such instances of integration occurred during Labor governments.

The years served under a minister or department which had combined sector responsibilities (for example, a minister responsible for both energy and food or a department responsible for water and food) are shown in Table 9.4.

Table 9.4: Years served under a minister and government department responsible for more than one sector (1901 to 1938)

Jurisdiction	Ministers						Government Department					
	Years	% of period	EW	EF	WF	EWF	Years	% of period	EW	EF	WF	EWF
COM	7	18%	✓	✓			7	18%	✓	✓		
NSW	27	71%	✓	✓	✓		29	76%	✓	✓		
VIC	35	92%	✓		✓	✓	38	100%	✓			
QLD	7	18%			✓		7	18%			✓	
SA	27	71%	✓	✓	✓	✓	31	82%			✓	
TAS	11	29%	✓	✓		✓	25	66%	✓			
WA	8	21%	✓	✓	✓		-	-	-	-	-	-

Source: Author's compilation from analysis in Appendix I

Table 9.4 shows that in NSW, Victoria and SA, ministers and government departments were responsible for more than one sector for more than 50% of the time during the period. In other states, ministers and departments responsible for more than one sector served for fewer years. Victoria was the leading state for both integrated ministerial responsibilities and government department responsibilities. These years were characterised predominantly by combined mining and water responsibilities at the ministerial level and at the department level. In SA, the years reflected mostly combined water and agriculture responsibilities and in NSW, these years reflected mostly combined mining and water as well as electricity and water responsibilities. Compared with the previous period, there were greater instances of integration seen across the country in more jurisdictions, in terms of years and in sector combinations.

Mismatch between the years served by ministers and years served by departments indicates some asymmetry between integration at both levels. Asymmetry was evident both in the years served by ministers and years served by departments with cross-sectoral responsibilities during this period. For example, in Victoria, SA, Tasmania and WA while there were ministers with cross-sectoral responsibility, there was no corresponding department with the same cross-sectoral responsibilities. Large differences in the years served between ministers and departments were seen in Tasmania.

Table 9.5 shows that at the Commonwealth level and in NSW, Victoria and SA, non-Labor governments served the most years with a minister and department with cross-sector responsibilities, hence mostly responsible for integration during the period. The table also shows that for the majority of their time in government, such governments had a minister and department with cross-sector responsibilities. In Queensland, Tasmania and WA, Labor governments served the most years with a minister and department with cross-sector responsibilities. In Queensland,

this was reflective of combined water and food responsibilities. In Tasmania, this was reflected in mostly combined energy-water responsibilities as well as energy and food responsibilities.

Table 9.5: Years served under a minister and government department responsible for more than one sector by government (1901 to 1938)

Jurisdiction	Minister							Government Department					
	Party	Years	% total years in govt.	EW	EF	WF	EWF	Years	% total years in govt.	EW	EF	WF	EWF
COM	Non-Labor	7	26%	✓	✓			7	26%	✓	✓		
	Labor	-	-					-	-				
NSW	Non-Labor	21	78%	✓	✓			29	85%	✓	✓		
	Labor	6	55%	✓				6	55%	✓			
VIC	Non-Labor	29	91%	✓		✓		32	100 %	✓			
	Labor	6	100%	✓		✓		6	100 %	✓			
QLD	Non-Labor	-	-					-	-				
	Labor	7	33%			✓		7	33%			✓	
SA	Non-Labor	18	78%	✓	✓	✓	✓	19	83%			✓	
	Labor	9	60%	✓		✓	✓	12	80%			✓	
TAS	Non-Labor	5	19%				✓	14	54%	✓			
	Labor	6	50%				✓	11	92%	✓			
WA	Non-Labor	-	-					-	-				
	Labor	8	42%	✓	✓	✓		-	-				

Source: Author's compilation from analysis in Appendix I

Period 3: World War II and the post-war economy (late 1930s to late 1960s)

This period saw greater involvement by the Commonwealth government in economic management, recovery, development and growth where full employment was a key objective. Government involvement was particularly prominent in the agricultural sector, where a number of statutory authorities became responsible for the acquisition, sale, disposal and marketing of a number of rural products. By the end of the period, the electricity industry in each state was centralised with generation, transmission and distribution, construction, development and regulation becoming the responsibilities of large state electricity authorities. During the period, the government embarked on one of the most significant infrastructure projects, the Snowy-Mountains Hydro Scheme, a dual electricity and water project. It also represented the

Commonwealth's first major involvement in water resources. Water infrastructure development was a feature during the period.

Energy and water

Energy and water developments remained intertwined. At the Commonwealth level, energy and water were part of broader resource development. From the 1950s, energy and water resource development matters were combined in the National Development portfolio, with a corresponding minister and department. During the period, the importance of energy and water for economic development was reflected in the new portfolio and in the government's new responsibilities to deal with matters related to the production, importation, distribution, sale and use of energy resources such as coal, fuel and petroleum.[23] The Department maintained its administration of water legislation. The Commonwealth's involvement in the Snowy Mountains Hydro-Scheme was furthermore an example of involvement in both energy and water areas.

At the state level, instances of integration between energy and water were seen in NSW, Victoria, and Tasmania, similar to previous periods. In NSW, the responsibilities of the Minister for Local Government included water and electricity This was seen at the portfolio, ministerial and department level. Energy and water were governed jointly throughout the entire period by the Department of Works and Local Government, followed by the Department of Public Works responsible for water and electricity (NSW Government State Archives & Records 2017b). . This was seen at both portfolio and ministerial levels.

In Victoria, mines and water (groundwater) were jointly governed by the Mines Department and corresponding ministers for mines were also responsible for groundwater. Electricity and water were jointly governed under the minister responsible for both for the water supply portfolio and the Electrical Undertakings portfolio (1935-1943 and 1944). In Tasmania, joint governance of electricity and water continued in line with the states hydroelectricity developments, as seen in portfolios, ministers and organisations responsible for hydroelectricity matters.

Energy and food

The integration of energy and food was less prominent across the states, some examples being NSW, Victoria and WA. In NSW, Rural Electricity Subsidies granted in 1946, were administered by the Electricity Authority and for a very short period, a minister was responsible for mines, agriculture and food production portfolios (1957). In Victoria, a minister was responsible for the mines and agriculture portfolios (1935-1942, 1945-1953). However, the minister responsible for

[23] Australia, *Commonwealth of Australian Gazette*, No 71, 23 November 1950, pg. 3096

mines would also have been responsible for groundwater. In WA, a Minister for Agriculture and Electricity was appointed (1962 to 1971).

Water and food

Water and food developments continued to be interdependent, particularly given the emphasis on protecting agricultural industries. Guaranteed pricing schemes to support farmers' incomes prevented farmers from understanding the real cost of water upon which agricultural production relied. Farm water supply legislation was seen in NSW (Farm Water Supplies Act 1946), Victoria (Farm Water Supplies and Drainage Advances Act 1943) and Queensland (Farm Water Supply Assistance Acts 1958).

At the ministerial and decision-making levels, the integration of water and food was seen in NSW, Victoria, Queensland, SA and WA. These ministers included: in NSW, the Minister for Agriculture and Conservation (1962-1965) and in Victoria, the minister responsible for both the agriculture and water supply portfolio (1952-1955). In Queensland, the joint governance of water and food continued during the period evident in the Lands Department and the Irrigation and Water Supply Commission responsible for irrigation. Water and food was the responsibility of the Secretary followed by the Minister for Public Lands and Irrigation (1950-1965). In SA, the integration of water and food was similarly associated with irrigation at the portfolio level, represented by the Minister for Irrigation and department responsibilities. Water and food were governed jointly throughout the period by the Department of Agriculture and Lands Department.

Energy, water and food

There were almost no instances of integration of EWF during the period. The only instances were evident in Victoria, as previously mentioned, with the Minister for Agriculture and Mines also being responsible for groundwater, and evident in Tasmania seen in the appointment of the Minister administering the Commerce and Industry division of the Department of Agriculture and administering the Hydro-electric Commission Act (1943-1947). In 1946, the Commonwealth policy *A Rural Policy for Post-War Australia* referred to the importance of water and electricity as inputs in agriculture, but no specific measure or strategy related to water and electricity was mentioned. Integration was limited to that between two sectors.

Integration by jurisdiction

Integration of EWF varied during the period across the states under various governments. Table 9.6 shows the political parties in power during the period.

Table 9.6: Political parties in power (1939 to 1969)

Jurisdiction	COM	NSW	VIC	QLD	SA	TAS	WA

Political Party	Country-UAP United Australia Party Labor Liberal Country	Labor Liberal	United Country Party Labor Liberal Country Electoral Reform League Liberal & Country Party	Labor Country Liberal	Liberal & Country League Labor	Labor Liberal	Liberal Labor Liberal & Country League

Source: Australian Politics and Elections Database, University of Western Australia 2018

Across all jurisdictions, there was at least one instance of integration between two sectors and only in Victoria and Tasmania were there instances of three-sector integration. In all states, integration occurred during both non-Labor and Labor governments. Farm water legislation in NSW, Victoria and Queensland were enacted by both Labor (in NSW) and Country parties.

At the Commonwealth level, integration was evident between energy and water and energy and food during both Labor and non-Labor parties, including the Country and United Australia party, United Australia Party and Liberal parties.

In NSW, integration was seen between energy and water, energy and food and water and food, limited to two-sector integration. In Victoria, integration was seen between energy and water and water and food and between all three sectors. In SA, integration was exclusively between water and food. In Tasmania, integration, as in previous periods, was between energy and water and between all sectors. In WA, integration was seen between energy and food, and water and food.

The years served under a minister or department which had combined sector responsibilities (for example, a minister responsible for both energy and food or department responsible for water and food) are shown in Table 9.7.

Table 9.7: Years served under a minister and government department responsible for more than one sector (1938 to 1969)

Jurisdiction	Minister						Government Department					
	Years	% of period	EW	EF	WF	EWF	Years	% of period	EW	EF	WF	EWF
COM	29	94%	✓	✓			28	90%	✓	✓		
NSW	31	100%	✓	✓	✓		31	100%	✓			
VIC	31	100%	✓		✓	✓	31	100%	✓			
QLD	29	94%	✓		✓		7	23%			✓	
SA	31	100%			✓		31	100%			✓	
TAS	9	29%	✓			✓	31	100%	✓			
WA	13	42%		✓			31	100%			✓	

Source: Author's compilation from analysis in Appendix I

In NSW, Victoria and SA, integration at the ministerial level and department level prevailed over the entire period. Every government in these states had a minister or department with multiple sector responsibilities. At the Commonwealth level and in Queensland, a minister responsible for more than one sector served for more than 90% of the period while in Tasmania and WA, a minister responsible for more than one sector served for less than half of the period. A department responsible for more than sector existed for almost the entire period in all jurisdictions except in Queensland. Compared with the previous period, greater instances of integration were seen across the country in terms of years and sector combinations.

Asymmetry between years served by ministers and years served by departments, as in the previous period was indicated. In NSW, Victoria, Queensland, Tasmania and WA while there were ministers with cross-sectoral responsibilities, there was no corresponding department with the same cross-sectoral responsibilities. Large differences in the years served between ministers and departments were seen in Tasmania, where the years served by departments exceeded those served by ministers and in Queensland, where the years served by ministers exceeded those served by cross-sectoral departments.

Table 9.8 shows that at the Commonwealth level and in Victoria, SA and WA, non-Labor governments appeared to have served the most years with a minister and department with cross-sector responsibilities. Table 9.8 also shows that for the majority of their time in power, such governments had a minister and department with cross-sector responsibilities. Non-Labor governments, however, dominated the period in these states which may explain this. In NSW, Queensland and Tasmania, Labor governments appeared to serve the most years with a minister and department with cross-sectoral responsibilities. Both parties, however, were responsible for

different types of sector combinations, indicating there was no obvious preference for the integration of specific combinations between parties.

Table 9.8: Years served under a minister and government responsible for more than one sector by government (1938 to 1969)

Jurisdiction	Minister							Government Department					
	Party	Years	% total years in govt.	EW	EF	WF	EWF	Years	% total years in govt.	EW	EF	WF	EWF
COM	Non-Labor	21	91%	✓	✓			22	96%	✓	✓		
	Labor	8	100 %	✓	✓			6	75%	✓		✓	
NSW	Non-Labor	7	100 %	✓				7	100 %	✓			
	Labor	24	100 %	✓	✓	✓		24	100 %	✓			
VIC	Non-Labor	26	100 %	✓			✓	26	100 %	✓			
	Labor	5	100 %	✓		✓	✓	5	100 %	✓			
QLD	Non-Labor	13	100 %	✓		✓		-	-				
	Labor	16	100 %			✓		7	39%			✓	
SA	Non-Labor	28	100 %			✓		28	100 %			✓	
	Labor	3	100 %			✓		3	100 %			✓	
TAS	Non-Labor	1	100 %	✓				1	100 %	✓			
	Labor	8	27%	✓			✓	30	100 %	✓			
WA	Non-Labor	9	53%		✓			17	100 %			✓	
	Labor	4	29%		✓			14	100 %			✓	

Source: Author's compilation from analysis in Appendix I

Period 4: Economic reform, globalisation and environmental awareness (1970 to late 1990s)

The 1970s onwards represented a shift in the economic trajectory of the country, from being supported and dependent on government intervention and a statist approach to a market-based economy. Economic reforms redefined government involvement in EWF sectors and their development. As the sectors continued to play a role in contributing to economic growth, each sector underwent reform. Changes were characterised by a shift from assistance and protection in

agricultural sectors, exploitation of water and predominantly the state provision of electricity to a competitive agricultural market, environmental considerations to shape sustainable water management and the corporatisation, commercialisation, deregulation and competition in the electricity industry. During the period, the country faced a range of problems in each domain, from oil security, water scarcity and degradation and low competitiveness and low productivity in agriculture and electricity sectors. The Commonwealth government played a greater role in national policy-making to address these issues.

The period from the 1970s to the start of the new millennium involved the completion of the Snowy Mountains Hydro Scheme, the development of the National Electricity Market and the establishment of the Murray Darling Commission, representing areas in which EWF sectors interact and areas where multiple states and jurisdictions also interact.

Energy and water

At the Commonwealth level, the integration of energy and water was seen in a number of portfolios: National Development; Natural Resources; Trade and Resources; National Development and Energy and Resources and Energy, each portfolio with corresponding ministers and departments. Each portfolio continued to highlight the resource development focus associated with energy and water, corresponding to a number of energy and water policies and programs. These included the National Water Resources Development Program (1978) along with the National Water Resources (Financial Assistance) Act 1978, and later, the Federal Water Resources Program (1984), the *Australian Energy Policy Review* (1979), *Water 2000* report in 1983 followed by the Commonwealth Water Policy statements (1979, 1984) and the *Energy 2000* National Energy Policy Paper (1988). This highlighted the importance of energy and water during the period. The *Sustainable Energy Policy* documents during the mid-1990s referred to water impacts of energy use and production. In 1975, the Snowy Mountains Hydro-Electric Power Act was enacted.

In NSW, the integration of energy (electricity) and water was seen in the responsibilities of the Department of Public Works (as in previous periods) and was also seen in the number of ministers responsible for the Local Government portfolio, Mines and Conservation portfolio, Energy and Water Resources portfolios. The Energy and Utilities Administration Act enacted in 1987 indicated a connection between energy and water. While concerned with the management of energy supply and use, it also made provisions for water use and savings. In 1987, the first government departments for energy and water were established, the Department of Energy and the Department of Water Resources, transferring the functions of previous statutory authorities, the Electricity Authority and the Water Resources Commission to government departments (NSW Government State Archives & Records 2017a). In Queensland, the Minister for Local

Government and Electricity (1968-1975) also reflected combined responsibilities over water and energy early in the period.

In Victoria, energy and water were integrated under several ministers. Ministers responsible for mines remained responsible for groundwater matters, including the Minister for Mines (also the Minister for Fuel & Power) (1970-1977) and Minister for Minerals and Energy (1977-1985). The Minister for Minerals and Energy was also the Minister for Water Supply (1982-1985) and another minister responsible for both energy and water included the Minister for Industry, Technology and Resources (1985-1991). Each was supported by corresponding government departments. From 1982 to 1985, both energy-related and mine-related portfolios and water supply portfolio were allocated to one minister, with primary responsibilities for energy and water, not only groundwater. Integration of energy and water continued to be attributed to hydroelectricity in Tasmania and in WA, energy and water were governed jointly by the minister responsible for the works, water supplies and electricity portfolios, however, only in 1971.

In the Northern Territory, a few ministers had energy and water responsibilities. These ministers included: the minister responsible for both mines and energy portfolio and conservation portfolio (1988), the minister responsible for the Mines and Energy portfolio and the Lands, Planning and Environment portfolio (1995-1997), the Minister for Power and Water (1996-1997) and the Minister for Essential Services (1998-2002). In the Australian Capital Territory, the Minister for Housing and Urban Services (1989-1990), followed by the Minister for Finance and Urban Services (1990-1991) and then Urban Services (1991-2001) was responsible for public utilities, including the use and supply of energy, water supply and sewerage services, stormwater and drainage and waste management[24]. Following the restructure of the electricity industry, regulatory bodies were established in NSW and Victoria to regulate electricity and water pricing.

Energy and food

The integration of energy and food responsibilities was mostly associated with primary industry matters, combining mining, resources and agriculture.

In NSW, energy and food were integrated from 1993 to the end of the period with the minister responsible for the agriculture and fisheries portfolio and the mines portfolio (1993-1995), followed by the minister responsible for the mines and fisheries portfolios (1995-2003). In Victoria, the integration of agriculture and resources (energy and food) was seen at the portfolio, ministerial and department levels under the Department of Agriculture, Energy and Minerals (1995-1997). In Queensland, the integration of energy and food was evident under the minister

[24] Australian Capital Territory, *Australian Capital Territory Government Gazette,* No. S1, 18 May 1989

responsible for the mines and energy portfolio and primary industries portfolio (1982 and 1987). In SA, the joint governance of energy and food was evident the minister responsible for the primary industries portfolio and the minerals and energy portfolio (1998-2000), and prior to that, the Department of Primary Industries and Resources (1997-1999). Similar ministers were seen in Tasmania in the 1990s, responsible for the combined Primary Industry, Fisheries and Energy portfolios. In WA, a Minister for Agriculture and Electricity served in 1970 and in the 1980s, two ministers in the NT were responsible for energy and water, both responsible for the mines and energy portfolio and the primary production portfolio.

At the policy level, linkages between energy and food were seen in the recognition of food production impacts on emissions, as trade-offs between food production and reductions emissions were noted in the Prime Minister Howard's response to climate change. In NSW, the Rural Electricity Subsidy Scheme continued to operate until 1982.

Water and food

Water for food remained an important linkage. At the Commonwealth level, the integration of water and food was seen after 1998 with the Agriculture, Fisheries and Forestry portfolio with corresponding ministers and departments.

In NSW, water and food were governed together under the minister responsible both the agriculture and water resources portfolios (1975-1977) and the minister responsible for both the agriculture and land and water conservation portfolio (1977-2001). In Victoria, the Rural Water Commission was responsible for irrigation (1984-1992).

In Queensland, the integration of water and food was evident in the portfolio for Primary Industries, which after 1989 until 1996 included water in the portfolio. In 1996, water was transferred to the Natural Resources portfolio (QLD Department of Natural Resources 1996). Both portfolios had a corresponding minister and a corresponding department, the Department of Primary Industries followed by the Department of Natural Resources (1996-2001).

In SA, the integration of water and food was evident in portfolios, ministers and departments with emphasis on agriculture and irrigation. Water and food were governed jointly under the Minister for Irrigation (1970-1978) followed by the minister responsible for the water resources and irrigation portfolios (1979-1982). The Minister for Primary Industries, Natural Resources and Regional Development was made responsible for water and food (1997-1999). The Department of Agriculture was responsible for food and water until 1975, and was responsible for agriculture, farm water schemes, the provision of an advisory service on water conservation, irrigation designs on farms, and the suitability of underground water for irrigation and stock purposes (ABS 1976).

In Tasmania, the integration of water and food was seen at the ministerial level with the appointment of a minister responsible for the primary industry portfolio and the water resources portfolio (1979-1986). The *State Policy on Water Quality Management* (1997) mentioned agricultural water uses and irrigation. The integration of water and food in WA was seen in the appointment of the minister responsible for the agriculture portfolio and the water resources portfolio (1989-1993). In the NT, the Minister for Primary Production and Conservation (1982) followed by the minister responsible for the conservation portfolio and the primary production portfolios (1984-1985, 1987 and 1990-1992) was responsible for water and food. In the ACT, the Minister for the Environment, Land and Planning had water and food responsibilities. Most integration between water and food was evident in the responsibilities of ministers.

At the policy level, Commonwealth policies for water were tied to agriculture, particularly as agricultural users were the largest users of water. These included funding programs to assist water developments in rural areas in the late 1970s and 1980s with water reforms also targeting agricultural use in the mid to late 1990s. The funding programs commenced during the Fraser and the Hawke governments where water was the responsibility of ministers who were also responsible for energy. Rural stabilisation schemes and adjustment schemes to transition farming industries towards greater exposure to competition were implemented during the period. Agricultural policies such as the *Economic and Rural Policy Statement* (1986) mentioned the importance of irrigation, and the *Primary Industry and Rural Policy* (1987) also referred to the importance of water to enhance rural resources. The *Economic Rural Policy Statement* (1986) was delivered while water and food were, however, the responsibilities of separate ministers who were also responsible for the National Development and Energy portfolio and the Primary Industry portfolio. The *Primary Industry and Rural Policy* (1987), however, was delivered while EWF were governed by the Minister for Primary Industries and Energy with the corresponding department.

Energy, water and food

During this period, for the first time at the Commonwealth level, EWF were dealt with together. This was seen with the Primary Industries and Energy portfolio (1987-1998), with corresponding ministers and departments created during the Hawke Labor government.

Full integration of EWF was evident in the responsibilities of various departments including in NSW, the Department of Planning (1980-1994), in Victoria, the Department of Conservation and Natural Resources (1992-1995) and the Department of Natural Resources and the Environment (1996-1999) and in Tasmania, the Department of Primary Industry, Fisheries and Energy in 1992, followed by the Department of Primary Industry and Fisheries (1993-1997).

In the ACT, integration was seen with the Minister for Housing and Urban Services and the Minister for Finance and Urban Services, both responsible for EWF areas (1989-1991). The smaller ministry might explain the combination of these ministerial responsibilities.

While Commonwealth policies during the period largely targeted specific sectors, a number referred to other sectors, reflecting an acknowledgement of the other sectors. However, only a brief mention was made of the other sectors. These included water and agriculture policies such as the *Food and Nutrition Policy* (1992), *National Water Quality Management Strategy* (1994) and the *Guidelines for Groundwater Protection* (1995). Policies during the Keating Labour government included the *National Greenhouse Responsible Strategy* (1992), *National Strategy for Ecologically Sustainable Development* (1992) and the National Competition Policy (1995), which were broad-based policies relevant to EWF sectors.

In this fourth time period, at the Commonwealth level, policies that reflected some consideration of all sectors were seen during the Keating Labor government, where EWF were governed together by a minister responsible for all EWF matters and also during the Howard Liberal government with policies containing references to other sectors.

Integration in state policies was limited to a mention of other sectors, while no joint EWF policies were introduced. In the NSW, the *State Groundwater Policy Framework* (1997) and *Groundwater Quality Protection Policy* (1998) promoted the need to consider groundwater management in relation to agriculture, land use, mining and energy. The *Victorian Renewable Energy Government Policy Statement* (1985) made minor mention of agriculture and water.

Integration by jurisdiction

The period from 1970 and 1999 was less diverse than the previous periods in terms of government turn over and government political parties. Labor or Liberal governments were the norm.

Table 9.9: Political parties in power (1970 to 1999)

Jurisdiction	COM	NSW, VIC, SA, TAS	QLD	WA	NT	ACT
Political Party	Labor Liberal	Labor Liberal	Country National Labor	Liberal Labor Liberal & Country League	Country Liberal	Labor Liberal

Source: Australian Politics and Elections Database, University of Western Australia 2018

Tables 9.10 and 9.11 show a fall in the number of years in which a minister or department with multiple sector responsibilities served since the previous period. Only at the Commonwealth level and in the ACT was a minister or department with multiple sector responsibilities in power for the entire period. In NSW and Victoria, a minister and department responsible for multiple sectors

served for at least 80% of the time while in other states, Queensland, SA, WA and the NT, such a minister and department only served for half or less than half the period. Instances of full integration were only evident in the Commonwealth and ACT; in other states, only partial integration was seen between energy and water, water and food, and energy and food. WA had the least number of years where a minister was responsible for multiple sectors. In WA, no government department during the period had multiple sector responsibilities.

Table 9.10: Years served under a minister and government department responsible for more than one sector (1970 to 1999)

Jurisdiction	Minister						Government Department					
	Years	% of period	EW	EF	WF	EWF	Years	% of period	EW	EF	WF	EWF
COM	30	100%	✓		✓	✓	30	100%	✓		✓	✓
NSW	29	97%	✓	✓	✓		26	87%	✓			✓
VIC	24	80%	✓	✓			28	93%	✓			✓
QLD	14	47%	✓	✓	✓		11	37%			✓	
SA	15	50%		✓	✓		25	83%		✓	✓	
TAS	21	70%	✓	✓	✓		18	60%	✓		✓	✓
WA	6	20%	✓	✓	✓		-	-				
NT	13	50%	✓	✓	✓		1	4%	✓			
ACT	11	100%	✓			✓	-*	-				

*Department information not available for ACT

Source: Author's compilation from analysis in Appendix I

Compared with the previous period, while instances of integration at the ministerial level rose at the Commonwealth level and in Queensland and Tasmania, the other states, NSW, Victoria, SA and WA experienced a decline in integration seen in the number of years served. At the department level, instances of integration only rose in Queensland.

Asymmetry between years served by ministers and years served by departments, as in the previous period was indicated. In all jurisdictions except for the Commonwealth and SA, while there were ministers with cross-sectoral responsibilities, there was no corresponding department with the same cross-sectoral responsibilities. Large differences in the number of years served between ministers and departments were seen in SA and NT.

Table 9.11: Years served under a minister and government department responsible for more than one sector by government (1970 to 1999)

Jurisdiction	Minister							Government Department					
	Party	Years	% total years in govt.	EW	EF	WF	EWF	Years	% total years in govt.	EW	EF	WF	EWF
COM	Non-Labor	14	100%	✓		✓	✓	14	100%	✓		✓	
	Labor	16	100%	✓			✓	16	100%	✓			✓
NSW	Non-Labor	12	92%	✓	✓	✓		13	100%	✓			✓
	Labor	17	100%	✓	✓	✓		13	76%	✓			✓
VIC	Non-Labor	15	79%	✓		✓		19	100%	✓			✓
	Labor	9	82%	✓				9	82%	✓			✓
QLD	Non-Labor	8	36%	✓		✓		3	14%			✓	
	Labor	6	75%			✓		8	100%			✓	
SA	Non-Labor	6	60%		✓	✓		6	60%		✓	✓	
	Labor	9	45%			✓		19	95%			✓	
TAS	Non-Labor	12	80%	✓	✓	✓		8	53%	✓		✓	✓
	Labor	9	60%	✓		✓		10	67%	✓		✓	
WA	Non-Labor	1	6%		✓			-	-				
	Labor	5	38%	✓		✓		-	-				
NT	Non-Labor	13	50%	✓	✓	✓		1	4%	✓			
	Labor	-	-					-	-				
ACT	Non-Labor	6	100%	✓		✓		-	-				
	Labor	5	100%	✓		✓		-	-				

Source: Author's compilation from analysis in Appendix I

Table 9.11 shows that in Victoria, Queensland, Tasmania and the NT, non-Labor governments served the most years where a minister was responsible for multiple sectors while in NSW, SA and WA, Labor governments shared the majority. In terms of departments, however, Labor parties in almost all states (except Victoria) accounted for the majority of years where a department had multiple sector responsibilities. At the Commonwealth level in NSW and the ACT, both non-Labor governments and Labor governments had a minister responsible for multiple sectors for the majority of their time in power, indicating cross-sectoral responsibilities in the majority of ministries formed.

The number of years in which government ministries had ministers with cross-sectoral responsibilities for 50% or less than 50% of their time in power was seen in Queensland and WA

under non-Labor governments, SA under its Labor government and WA under both governments. WA had the least integration.

In the majority of states, a department responsible for multiple sectors existed for the majority of the time during both Labor and non-Labor governments. Only in WA was no government department responsible. Information on departments in NT and ACT was not available, hence a comparison is not possible.

Period 5: Post-reform economy and contemporary challenges (2000 to the present)

By this time, Australia had transitioned into a market-based economy. Except for a bout of Keynesianism seen in the implementation of fiscal stimulus during the Global Financial Crisis in 2008, the country has continued to follow a neoliberalist path. Further reform efforts were continually implemented during the period.

EWF sectors have nonetheless continued to play an important role. The agricultural sector has become competitive and is exposed to the international market, and to an extent, the energy sector has also become competitive with regulation where required, such as in transmission networks. Both sectors have contributed to the country's growth, with the country becoming a major exporter in both sectors. Water resources, however, continued to be a limiting factor to growth. Water reforms and the implementation of the National Water Initiative and the Murray Darling Basin Plan remain of importance. The need to reduce emissions, address climate change and transition towards a low carbon economy is increasingly challenging economic goals with environmental considerations. Such issues are becoming increasingly relevant to EWF sectors.

Recurring and worsening drought highlights the limits to the country's ability to exploit agriculture and the entrenched support for agriculture and preoccupation with the country's farmers (discussed earlier) as a cultural force has prevented alternative development. Similarly, the historical exploitation of fossil fuel industries has also invited opposition towards climate change policy to protect economic interests and Australia's competiveness. In Australia, energy and climate change policies have become highly politicised and complex issues, where action to address such issues has been prevented by a lack of bipartisan support coupled with internal party politics. Currently, drought and energy security (in terms of reliability, affordability and sustainability) are contemporary issues faced by the country. Linkages between EWF and their security are becoming increasingly felt.

Since the 2000s, the integration of EWF at the Commonwealth level has been limited to two sectors since the separation of energy matters from water and food into separate portfolios in the late 1990s. During the period, attention to water issues, in response to the millennium drought, placed water on the policy agenda and this was symbolised by the creation of a water-focused

portfolio in 2007. This was also reflected in the capacity with which separate matters can be dealt with separately. Across the states, the integration of EWF has varied.

Energy and water

Energy and water linkages during the period reflected consideration of environmental issues affecting both sectors, in contrast with the previous sole emphasis on resource development.

From the 2000s, the integration of EWF at the Commonwealth level has been limited to two sectors since the separation of energy from agriculture and water, previously all part of the Primary Industries and Energy portfolio (1987-1998). The integration of energy and water was evident under the Minister for Climate Change and Water (2007-2009), Minister for Climate Change, Energy Efficiency and Water (2010), supported by similar departments, Department of Environment, Water, Heritage and Arts (2008-2010) followed by the Department of Sustainability, Water, Population and Communities (2010-2013). This reflected the influence of environmental considerations in dealing with energy and water.

In NSW, the integration of energy and water has been evident across portfolios, ministers and departments, as seen in the portfolio for Energy and Utilities and its corresponding minister and department, alongside a number of departments with energy and water responsibilities. From the early 2000s to 2010, this has included the Ministry of Energy and Utilities (2000-2003), the Department of Infrastructure, Planning and Natural Resources (2003-2004), Department of Environment and Climate Change, Department of Energy, Utilities and Sustainability (2004-2006), Department of Natural Resources (2005-2006), Department of Water and Energy (2007-2008) and Department of Environment, Climate Change and Water (2009-2010). In Victoria, energy and water matters were dealt with jointly by the current Department of Environment, Land, Water and Planning. In Queensland, the integration of energy and water has been most prominent, as seen in the appointment of ministers responsible for the natural resources portfolio, the mines and energy portfolio. Ministers have also included the Minister for Energy and Water Utilities (2011-2012), the Minister for Energy and Water Supply (2012-2015) and the Minister for Energy, Biofuels and Water Supply (2015-current). Each minister was supported by a corresponding department. In SA, energy and water were dealt with by the Minerals and Energy Resources division under the Department of Primary Industries and Resources, responsible for groundwater (2000-2010), and the Department of State Development (2011-present). In WA, the integration of energy and water was only evident for a short period with a minister responsible for both the water resources portfolio and energy portfolio (2006).

In the NT and the ACT, energy and water were integrated under the Essential Services and Urban Services portfolios. Regulatory bodies in NSW, Victoria, SA and WA are currently responsible for energy and water regulation.

Energy and water integration is evident in legislation in Queensland, including the Energy and Water Ombudsman Act 2006 and the ACT Utilities ACT 2000.

Energy and food

Energy and food integration continues to reflect a primary industry, mining, resources and agriculture focus. At the Commonwealth level, however, energy and food matters have been paired under Industry; Industry and Science; and Industry, Innovation and Science portfolios, each with corresponding ministers and departments. Such pairing, however, reflects the industrial and manufacturing aspects of energy and food manufacturing.

In NSW, in the early 2000s, energy and food matters were the responsibility of the minister responsible for both mines portfolio and fisheries portfolio (1995-2003), followed by the minister responsible for the Primary Industries portfolio, the Energy portfolio, the Mineral Resources portfolio and the State Development portfolio (2007-2009). Department of Primary Industries (2004-2009) had both energy and food responsibilities. In Victoria, energy and food were integrated at the department level, jointly governed by the Department of Primary Industries (2002-2012) and more recently through the Department of Economic Development, Jobs, Transport and Resources (2015-present). In SA, energy and food were integrated under the Minister for Primary Industries and Resources, followed by the Minister for Mineral Resources Development, also Minister for Agriculture, Food and Fisheries. The Department of Primary Industries and Resources (2000-2010) was responsible for energy and food until replaced by the Department of Primary Industries and Regions (2011-2018).

In the NT, the integration of energy and food was evident throughout the period, as seen in the appointment of a minister responsible for the Mines and Energy portfolio and Primary Industry and Fisheries portfolio, and the Primary Industry, Fisheries and Resources portfolio. Intergration is evident with the Minister for Primary Industry and Resources.

Water and food

Water and food linkages continued to be shaped by a greater consciousness about sustainable water management and the need to manage water use by, particularly, agricultural users. The establishment of water markets and an emphasis on trade have become the primary means for allocating water. Environmental water and sustainable diversion limits are also an important element of water policy.

At the Commonwealth level, the integration of water and food was seen at the beginning of the period and towards the end of the period, firstly under the agriculture, fisheries and forestry portfolio (1998-2006), and then under the combined agriculture and water resources portfolio (2015-present), once water was transferred back to the agricultural portfolio from the

environmental portfolio. Both portfolios had a corresponding minister and department. Water was paired with agriculture during the implementation of the NWI but was its own portfolio when the Water Act 2007 was enacted.

In NSW, the joint governance of water and food was evident under the minister responsible for the Agriculture portfolio and the Land and Water Conservation portfolio (2000), and under the minister responsible for the Primary Industries portfolios and the Lands and Water portfolios from 2015 followed by the minister responsible for the Primary Industries portfolio and the Regional Water portfolio. Corresponding to these ministers was the Department of Primary Industries from 2017. In Queensland, water and food were integrated under the Department of Natural Resources until 2001. In Victoria, the integration of water and food occurred at the ministerial level, with the appointment of a minister responsible for the Agriculture and Food Security portfolio and also for the Water portfolio (2010-2014). In 2015, the Department of Environment and Primary Industries was made responsible for water and food. In Tasmania, the integration of water and food continued throughout the period. This was seen at the ministerial level, with the Minister for Primary Industries and Water (2004-2006, and 2014-present). Since 1998, the departments responsible for water and food matters included the Department of Primary Industries, Water and Environment, followed by the Department Industries, Parks, Water and Environment since 2009. There was only one instance of water and food integration in WA, with the minister responsible for the water and fisheries portfolios.

In the NT, the Department of Health was responsible for both water and food safety, similar to the Minister for Health in the ACT. In SA, there was less emphasis on water and food compared with previous periods. The only instance of water and food integration was seen in the state's Irrigation Act 2004.

Energy, water and food

The integration of EWF was only evident at the state level and no longer at the Commonwealth level. In NSW, for example, the integration of EWF was evident at the ministerial level, with the minister responsible for the Natural Resources portfolio, Primary Industries portfolio and Mineral Resources portfolio (2005-2007), combining EWF, and at the department level, seen in the Department of Industry and Investment, Department of Trade and Investment, Regional Infrastructure and Services, and Department of Industry, Skills and Regional Development. The Departments, however, were not sector-focussed but combined EWF responsibilities with other industry, trade and economic development matters. At the beginning of the period, EWF in Victoria were jointly governed by the Department of Natural Resources and the Environment and in Queensland, by the Department of Employment, Economic Development and Innovation (2009-2011). In Tasmania, EWF were the combined responsibilities of several ministers (2006-

2014). The portfolios of these ministers included the Primary Industries and Water portfolio, the Primary Industries, Water and Energy portfolio and the Energy and Resources portfolios.

In the NT, the integration of EWF was evident at a ministerial level with the appointment of ministers for the following portfolios: Primary Industry and Fisheries; Essential Services; Land Resource Management; Natural Resources, Environment and Heritage, Mines and Energy (2012-2016). In the ACT, the integration of EWF was evident in portfolios and ministers, including the Regulatory Services portfolio involving regulation of EWF and the appointment of the minister responsible for the Planning portfolio and the Health portoflio (responsible for food safety) (2004 -2006), the minister responsible for the Environmental portfolio and the Health portfolio (2015) and the minister responsible for the Environmental and Climate Change portfolio and the Health portfolio (2016). Corresponding departments included the Environment, Planning and Sustainable Development Directorate and the Economic Development directorate.

In SA, EWF responsibilities integrated at the ministerial or department level under the Minister responsible for mines (including groundwater) and agriculture portfolios, and the Department of Primary Industries and Resources. The state's Natural Resources Management Act in 2004 also provided the means for accounting for linkages and managing the impacts between EWF.

There have been various EWF policies at the Commonwealth and across the states including broader economic policies and in particular, state climate change policies, both of which have been relevant to EWF sectors. As seen in the previous chapters, the integration of EWF as reflected by policies and legislation was limited particularly in legislation where linkages were less obvious and covered at the detailed level of legislation. Although policies appear to consider other sectors, references to other sectors were often brief and narrow, referring to a specific aspect related to either energy, water or food, for example, most water references in energy policies refer to water in terms of solar hot water systems. Policies did not reflect an in-depth consideration of how EWF policies may interact. Most water policies however were often linked and directed to agricultural users as seen in frequent references to irrigation. Except for water policies, most policies are largely sector-specific. Economic plans and climate change plans encompass plans for energy, water and agriculture which continue to reflect the sectors' importance in meeting economic and environmental objectives.

In this period, the most Commonwealth policies that reflected consideration of all sectors were seen during the Gillard Labor government which surprisingly was during a time when ministers had separate responsibilities and departments were also separate. The only exception was in 2010 when a Minister for Climate Change, Energy Efficiency and Water was in power.

In NSW, during the fourth and fifth period, policy in the such as the *State Groundwater Policy Framework* (1997), the *NSW Policy for Sustainable Agriculture* (1998) and the *NSW*

Conservation Strategy (2000) were implemented when there was a single minister responsible for the Agriculture portfolio and the Land and Water portfolio. Towards the end of the period, policies were implemented during a time when the government departments were responsible for all EWF matters. The *NSW 2021* (2011), the *Agriculture Industry Action Plan* (2014) and the *Climate Change Policy Framework* (2016) were examples of policies where other sectors were mentioned.

In Victoria, most policies reviewed included those produced during times when joint governance was seen at the department level, for example, during the time of the Department of Economic Development, Jobs Transport and Resources which was previously responsible for energy and agricultural matters (recently mostly responsible for agriculture) and the Department of Environment, Land, Water and Planning responsible for energy and water. The state's *Water for the Future Plan* (2016) had a number of references to other sectors and was produced by the Department of Environment, Land, Water and Planning.

In Queensland, during the Bligh Labor government, EWF policies were developed during the time of the Department of Employment, Economic Development and Innovation which was responsible for all three sectors. The most recent policies during the Palaszczuk Labor government have also corresponded to ministers with joint responsibility for energy and water.

In SA, recent policies were implemented during times of joint governance at the ministerial and department level with a minister responsible for mineral resources development, agriculture, food and fisheries portfolios, as well as the Department of Primary Industries and Regions both responsible for energy and agriculture matters, both under the recent Labor governments. Most policies, however, appeared to address all EWF sectors, the least being the state's energy plan which made little mention of agriculture and food-related impacts.

In Tasmania, policies were also developed during times of joint governance at the department level, particularly during the time of the Department for Primary Industries, Water and Environment. The *State Policy on the Protection of Agricultural Land* (2009) was one which made substantial reference to water and energy, concerning irrigation as well as the development of utilities and extractive utilities. In WA, policies were mostly siloed with only a brief mention of other sectors. The first two water plans were during the Carpenter Labor government while a minister responsible for both energy and water portfolios was in power. Only in the *State Water Plan* (2007) was energy mentioned throughout.

In the NT, the most recent policies were also during ministries where ministers were responsible for multiple sectors. The state's water plan also referred to agriculture and petroleum development. Despite ministers and departments with responsibilities covering EWF, in the ACT, policies, however, were mostly siloed with very little mention of other sectors.

More recent policies under the Commonwealth's Liberal governments, however, have been sector-specific, although some made references to other sectors, for example, the *Domestic Gas Strategy* (2015) and the *Energy White Paper* (2014) considered both energy and agriculture matters. In the *Agricultural Competitiveness White Paper* (2015), the development of water infrastructure was a key strategy.

Integration by jurisdiction

In the final period, all states reflected some sort of sector integration although mostly two-sector integration. Integration was seen in both types of governments during the period which was dominated by Labor and Liberal parties.

Table 9.12: Political parties in power (2000 to the Present)

Jurisdiction	COM	NSW, VIC, SA, TAS, QLD, WA	NT	ACT
Political Party	Labor Liberal	Labor Liberal	Country Liberal Labor	Labor Liberal

Source: Australian Politics and Elections Database, University of Western Australia (2018)

Integration included almost all sector combinations across the country. Table 9.13 shows that, compared with the previous period, the years of integration served by ministers had fallen in all jurisdictions (Commonwealth, NSW, Victoria, SA, Tasmania, WA and the ACT) except in Queensland and the NT. However, compared with the previous period, the years of integration served by departments rose in all jurisdictions, except in the Commonwealth. In jurisdictions except for the Commonwealth and NT, there was a department with cross-sectoral responsibilities throughout the entire period.

The NT, followed by Queensland, which previously had the least number of years and the Commonwealth, had the most number of years in which a minister with cross-sectoral responsibilities served, accounting for 100% and 84% of the period, respectively. WA had the least number of years, accounting for 16% or three years.

The integration of all three sectors was evident in the appointment of ministers in NSW, SA, Tasmania, NT and ACT and in the establishment of departments in NSW, Victoria, SA and ACT.

Table 9.13: Years served under a minister and government department responsible for more than one sector (2000 to Present)

Jurisdiction	Minister						Government Department					
	Years	% of period	EW	EF	WF	EWF	Years	% of period	EW	EF	WF	EWF
COM	16	84%	✓	✓	✓		18	95%	✓	✓	✓	

NSW	14	74%	✓	✓	✓	✓	19	100%	✓	✓		✓
VIC	10	53%	✓		✓		19	100%		✓	✓	✓
QLD	16	84%	✓				19	100%	✓			
SA	12	21%	✓	✓		✓	19	100%	✓	✓		✓
TAS	15	79%			✓	✓	19	100%			✓	
WA	3	16%	✓		✓		-	-	-	-	-	-
NT	19	100%	✓	✓	✓	✓	10	53%		✓	✓	
ACT	18	95%	✓		✓	✓	19	100%	✓			✓

Source: Author's compilation from analysis in Appendix I

Asymmetry between years served by ministers and years served by departments, as in the previous period was indicated. In all jurisdictions except for the Commonwealth, Queensland and SA, while there were ministers with cross-sectoral responsibilities, there was no corresponding department with the same cross-sectoral responsibilities. Large differences in the years served between ministers and departments were seen in Victoria and NT.

Table 9.14: Years served under a minister and government department responsible for more than one sector by government (2000 to Present)

Jurisdiction	**Minister**							**Government Department**					
	Party	Years	% total years in govt.	EW	EF	WF	EWF	Years	% total years in govt.	EW	EF	WF	EWF
COM	Non-Labor	13	100%		✓	✓		13	100%	✓	✓	✓	
	Labor	3	50%	✓				5	83%	✓			
NSW	Non-Labor	4	50%	✓		✓		8	100%				✓
	Labor	10	91%	✓	✓	✓	✓	11	100%	✓	✓		✓
VIC	Non-Labor	5	100%	✓		✓		5	100%		✓	✓	
	Labor	5	36%	✓				14	100%		✓		✓
QLD	Non-Labor	3	100%	✓				3	100%	✓			
	Labor	13	81%	✓				16	100%	✓			
SA	Non-Labor	2	67%		✓			3	100%	✓	✓		✓
	Labor	10	63%		✓		✓	16	100%	✓	✓		✓
TAS	Non-Labor	5	100%			✓		5	100%			✓	
	Labor	10	71%			✓	✓	14	100%			✓	
WA	Non-Labor	-	-	-	-	-	-	-	-	-	-	-	-
	Labor	3	33%	✓		✓		-	-	-	-	-	-
NT	Non-Labor	5	100%	✓			✓	3	60%		✓	✓	
	Labor	14	100%	✓	✓	✓		7	50%		✓	✓	
ACT	Non-Labor	1	100%	✓				1	100%	✓			

	Labor	17	94%	✓		✓	✓	18	100%	✓		✓

Source: Author's compilation from analysis in Appendix I

Table 9.14 shows the differences in cross-sector responsibilities between the two governments. The integration of the three sectors in relation to ministers occurred under the Labor governments in Tasmania and the ACT and during the non-Labor government of the NT. The integration of the three sectors in relation to departments occurred under the Labor governments in NSW, Victoria and ACT and in non-Labor governments in NSW.

During the period, a Labor cross-sectoral minister served for the majority of years in all jurisdictions except for the Commonwealth and Victoria. Labor cross-sectoral departments served for the majority of years in all jurisdictions except for the Commonwealth. In non-Labor governments in the Commonwealth, Victoria, Queensland, Tasmania and the Territories, ministers with cross-sectoral responsibilities served for the party's entire time in government. In all jurisdictions except for the Commonwealth and NT, a department with cross-sectoral responsibility was in power for the entire period.

In the Commonwealth, NSW, Victoria, Queensland, Tasmania and NT, both Labor and non-Labor governments had a minister with cross-sectoral responsibilities for the majority of the years each government was in power. As the results are varied, it is difficult to attribute integration to one party over the other.

Summary: Integration of EWF from the mid-1850s to the present

In Australia, the nexus between EWF and between EWF security has been shaped by the physical and geographical characteristics of the country and has been defined by the special roles EWF sectors have had in providing the basic needs of EWF, as well as contributing to national economic growth and development and in sustaining and maintaining livelihoods.

As discussed, the governments' involvement in EWF sectors has changed over time, characterised by changes to public sector involvement and the sharing of responsibilities between the multiple tiers of government which have been shaped by the processes of centralisation and decentralisation of EWF responsibilities. These changes have been in response to the need to address the economic and sector-specific issues of the time, to the dynamism of the economy and individual sectors, and to changing development philosophies.

The institutional settings for EWF, in terms of the level of government involvement and the role of government in EWF sectors, the policy and decision-making and authority structures, and the policy outputs have shown variation in the degree of integration to which EWF have been governed together. This also has varied across jurisdictions.

Integration was particularly evident in the policy, decision-making and authority structures (reflected by ministerial and departmental responsibilities). These were important as they reflected the structures by which EWF matters could be jointly governed. Policy outputs as reflected by policy, legislation and pricing processes, however, appear siloed and sector-specific rather than integrated with only a few instances of integration.

The findings show that in Australia, at the Commonwealth level and across the states, the integration of EWF at the ministerial and departmental levels has been evident across all five time periods. Table 9.15 lists the number of years served under a minister and government department responsible for more than one sector.

Table 9.15: Years served under a minister and government department responsible for more than one sector (mid-1800s to Present)

Jurisdiction	Minister						Government Department					
	Years	% of period	EW	EF	WF	EWF	Years	% of period	EW	EF	WF	EWF
COM	82	69%	52	13	13	11	83	70%	45	16	13	10
NSW	112	67%	81	30	13	2	115	71%	87	23	4	25
VIC	115	71%	99	6	23	13	122	75%	95	17	2	10
QLD	66	41%	28	2	36		44	28%	15		26	3
SA	85	59%	16	1	68	5	106	74%	0	5	84	12
TAS	56	34%	23	7	14	13	93	57%	66		23	4
WA	30	23%	4	17	9		31	24%			31	0
NT	32	71%	17	15	7	5	45	24%	1	8	8	0
ACT	29	97%	24		3	8	19	63%	17			1

Source: Author's compilation from analysis in Appendix I

Table 9.16 show that ministerial and departmental integration existed for all sectors, including two-sector integration (energy and water, energy and food, water and food) and three-sector integration (EWF). Reflected by the years served both by ministers and departments, the emphasis appears to be on energy and water, followed by water and food. The integration of all three sectors was evident at the ministerial level in all jurisdictions except Queensland and WA and at the department level in all states except WA and the NT. Table 9.16 also shows that of the jurisdictions and over all time periods, Victoria had the most years in which a minister and government department with cross-sector responsibilities served. These ministers and departments served for almost 71% and 75%, respectively of the time during the period, suggesting that for the majority of the periods in Victoria, there was integration of at least two sectors. In the two territories, the NT and the ACT, ministers with cross-sectoral responsibility also served for the majority of years since the introduction of self-government in 1974 and 1989,

respectively. WA had the least number of years in which a minister and government department with cross-sector responsibilities served. These ministers and departments served for only 23% and 24% respectively, a quarter of the time during the period.

The differences between the years served by a minister with cross-sectoral responsibility and by a department with cross-sectoral responsibility indicate asymmetries and possible weaknesses where integration at the ministerial level does not correspond with integration at the department level. For example, while ministers may be responsible for multiple sectors, the government departments that support them are only responsible for individual sectors and are not able to sufficiently inform or advise the minister of cross-sectoral issues. Although the years served by ministers and departments were not exactly the same, they were similar in most states. Large differences were seen in Queensland and the ACT where the number of years served by ministers exceeded the years served by departments. Large differences were seen in SA and Tasmania where the number of years served by departments exceeded the years served by ministers.

Table 9.16 shows the years served under a minister and government department responsible for more than one sector by government party. It is difficult to generalise the extent of integration by political party as the results varied across government parties and across jurisdictions.

At the ministerial level, for example, in NSW, Queensland, Tasmania, WA and NT, Labor party ministers with cross-sectoral responsibilities served for a greater number of years than non-Labor party ministers accounting for 90%, 65%, 46% and 96% of their time in government, respectively. On the contrary, at the Commonwealth level, in Victoria, SA and NT, non-Labor party ministers with cross-sectoral responsibilities served for a greater number of years than Labor party ministers, accounting for 71% (both at the Commonwealth and in Victoria), 60% and 58% of their time in government, respectively. At the department level, in the Commonwealth, NSW, Victoria, SA, WA, a non-Labor department with cross-sectoral responsibilities served for a greater number of years than Labor departments.

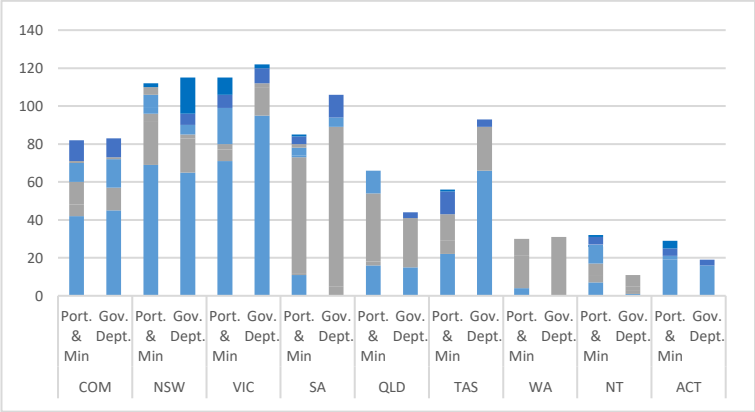
Table 9.16: Years served under a minister and government department responsible for more than one sector by government party group (mid-1800s to Present)

Jurisdiction		Minister						Government Department					
	Party	Years	% total years in govt.	EW	EF	WF	EWF	Years	% total years in govt.	EW	EF	WF	EWF
COM	Non-Labor	55	71%	✓	✓	✓	✓	56	73%	✓	✓	✓	✓
	Labor	27	66%	✓	✓	✓	✓	27	66%	✓	✓	✓	✓
NSW	Non-Labor	55	55%	✓	✓	✓		61	61%	✓	✓	✓	✓
	Labor	57	90%	✓	✓	✓	✓	54	86%	✓	✓	✓	✓
VIC	Non-Labor	90	71%	✓	✓	✓	✓	88	69%	✓	✓	✓	✓
	Labor	25	69%	✓		✓	✓	34	94%	✓	✓		✓
QLD	Non-Labor	24	25%	✓	✓	✓		6	6%	✓		✓	
	Labor	42	65%	✓		✓		38	58%	✓		✓	✓
SA	Non-Labor	54	60%	✓	✓	✓	✓	56	62%		✓	✓	✓
	Labor	31	57%	✓	✓	✓	✓	50	93%	✓	✓	✓	
TAS	Non-Labor	23	25%	✓	✓	✓	✓	28	30%	✓		✓	✓
	Labor	33	46%	✓	✓	✓	✓	65	92%	✓		✓	
WA	Non-Labor	10	14%		✓			17	23%			✓	
	Labor	20	36%	✓	✓	✓		14	25%			✓	
NT	Non-Labor	18	58%	✓	✓	✓	✓	4	13%	✓	✓	✓	
	Labor	14	100%	✓	✓	✓		7	50%		✓	✓	
ACT	Non-Labor	7	100%	✓			✓	1	14%	✓			✓
	Labor	22	96%	✓		✓	✓	18	78%	✓			✓

Source: Author's compilation from analysis in Appendix I

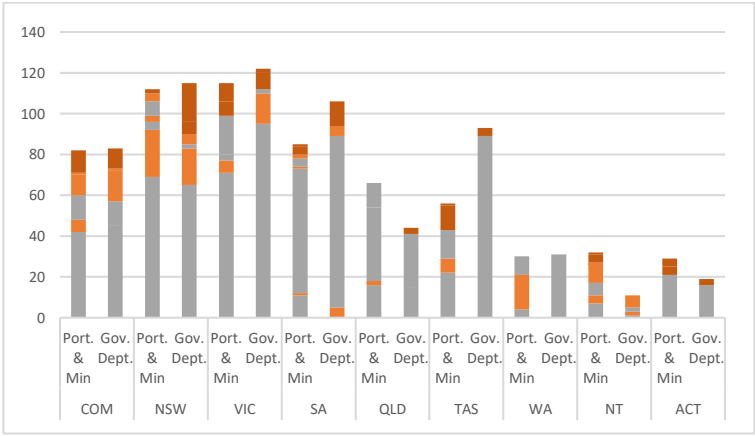
The sector combinations for which ministers and departments had cross-sectoral responsibilities, however, differed between the types of governments. Figures 9.1, 9.2 and 9.3 highlight the number of years in which ministers and departments had cross-sectoral responsibilities over energy and water, energy and food and water and food. Each bar measures the entire years with integration. The colours represent the sector combinations; blue represents years with energy and water integration, orange represents the years with energy and food integration and the green represents the years with water and food integration. Darker shades highlight years with full EWF integration. The figures shows an emphasis of integration between energy and water at the Commonwealth, NSW, Victoria and an emphasis of integration between water and food in South Australia.

Figure 9.1: Years served under a minister and government department with energy and water responsibilities



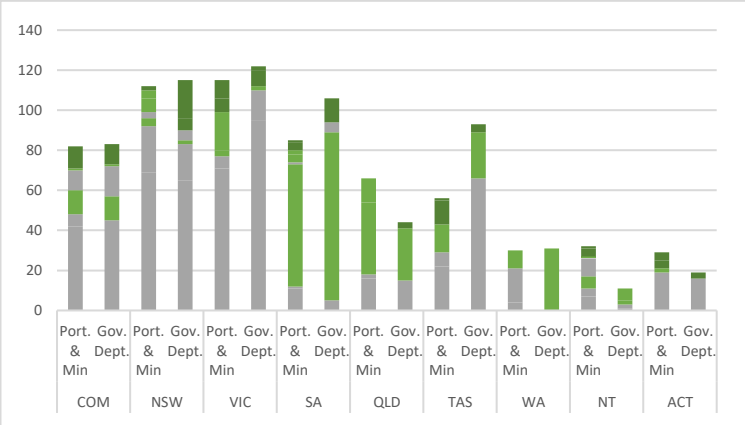
Source: Author's compilation from analysis in Appendix I

Figure 9.2: Years served under a minister and government department with energy and food responsibilities



Source: Author's compilation from analysis in Appendix I

Figure 9.3: Years served under a minister and government department with water and food responsibilities



Source: Author's compilation from analysis in Appendix I

Table 9.17 shows the number of years served by both ministers and departments responsible for all three sectors, showing that these years comprised a much smaller proportion of the total years served. Of the states (excluding territories), Victoria had the most years (16 years or 10% of all periods) with a minister responsible for all three sectors. The corresponding values for the ACT are 8 years or 27% of the period since ACT self-government. At the department level, NSW had the most years, with a department with cross-sector responsibility, serving for 25 years or 15% of all the periods. Table 9.18 shows that instances of EWF integration was seen in three of the five periods in Tasmania. However, even in the first period, despite no obvious minister or portfolio representing EWF, it was likely that EWF were jointly governed because of smaller ministries and the likelihood of ministers being responsible for multiple portfolios.

Table 9.17: Years served under a minister and government responsible for EWF (simultaneously) from the mid-1800s to the present

Jurisdiction	Minister							Government Department						
	Years	% of period	P1	P2	P3	P4	P5	Years	% of period	P1	P2	P3	P4	P5
COM	11	9%	-	-	-	11	-	10	8%	-	-	-	10	-
NSW	2	1%	-	-	-	-	2	25	15%	-	-	-	15	10
VIC	16	10%	-	4	12	-	-	10	6%	-	-	-	8	2
QLD	-	-	-	-	-	-	-	3	2%	-	-	-	-	3
SA	5	3%	-	3	-	-	2	12	8%	-	-	-	-	12
TAS	13	8%	-	1	4	-	8	4	2%	-	-	-	4	-
WA	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Jurisdiction	Minister							Government Department						
NT	5	11%	-	-	-	-	5	-	-	-	-	-	-	-
ACT	8	27%	-	-	-	2	8	1	5%	-	-	-	-	1

Source: Author's compilation from analysis in Appendix I

Table 9.18 shows that in the Commonwealth, NSW, SA, Tasmania and ACT Labor ministers with cross-sectoral responsibilities served for more years than non-Labor ministers. Only in Victoria and NT did non-Labor ministers serve for more years. In the Commonwealth, Queensland, SA and the ACT, Labor departments with cross-sectoral responsibilities served for more years than non-Labor departments. Only in NSW and Victoria did non-Labor (Liberal) departments with cross sectoral serve for more years than Labor departments.

Labor governments at the Commonwealth level, in Tasmania and the ACT had the highest percentage of years (22%, 17% and 30%) in which ministers had cross-sectoral responsibilities, suggesting that integration of all three sectors was more likely under a Labor government than a non-Labor government. In the NT and Victoria, these percentages were 14% and 10% for non-Labor governments.

Table 9.18: Years served under a minister and government responsible for EWF (simultaneously) in more than one sector by government (mid-1800s to present)

		Minister							Government Department						
	Party	Years	% total years in govt.	P1	P2	P3	P4	P5	Years	% total years in govt.	P1	P2	P3	P4	P5
COM	Non-Labor	2	3%	-	-	-	2	-	2	3%	-	-	-	2	-
	Labor	9	22%	-	-	-	9	-	8	20%	-	-	-	8	-
NSW	Non-Labor	-	-	-	-	-	-	-	15	15%	-	-	-	7	8
	Labor	2	3%	-	-	-	-	2	10	16%	-	-	-	8	2
VIC	Non-Labor	13	10%	-	4	9	-	-	7	6%	-	-	-	7	-
	Labor	3	8%	-	-	3	-	-	3	8%	-	-	-	1	2
QLD	Non-Labor	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Labor	-	-	-	-	-	-	-	3	5%	-	-	-	-	3
SA	Non-Labor	2	2%	-	2	-	-	-	2	2%	-	-	-	-	2
	Labor	3	6%	-	1	-	-	2	10	10%	-	-	-	-	10
TAS	Non-Labor	6	7%	-	1	-	5	-	4	4%	-	-	-	4	-
	Labor	12	17%	-	-	4	-	8	-	-	-	-	-	-	-
WA	Non-Labor	-	-	-	-	-	-	-	-	-	-	-	-	-	-

		Minister							Government Department						
	Party	Years	% total years in govt.	P1	P2	P3	P4	P5	Years	% total years in govt.	P1	P2	P3	P4	P5
	Labor	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NT	Non-Labor	4	13%	-	-	-	-	4	-	-	-	-	-	-	-
	Labor	1	7%	-	-	-	-	1	-	-	-	-	-	-	-
ACT	Non-Labor	1	14%	-	-	-	1	-	-	-	-	-	-	-	-
	Labor	7	30%	-	-	-	1	7	1	4%	-	-	-	-	1

Source: Author's compilation from analysis in Appendix I

It is also important to note that ministerial responsibilities may not necessarily reflect decisions in favour of joint governance. Much of the allocation of ministerial responsibilities is also largely politically driven and could be attributed to political decisions or strategies or party policies that are unrelated to the need to jointly govern sectors. Often distinct areas, for example, Immigration and Energy portfolios, were grouped as part of a minister's responsibility, which means that allocating multiple portfolios might not always be a sign of the need to holistically govern sectors.

Nonetheless, because of the linkages between the sectors, it is assumed that a minister responsible for either energy-water, energy-food, water-food and EWF matters, or even for separate portfolios, would consider these linkages and their wider policy impacts.

The degree of joint governance varied across the states reflecting state priorities. Another interesting point to make is that changes to ministerial responsibilities and departments did not necessary occur as a result of changes in leadership. Ministerial designations often remained after changes in government or leadership, showing that parties inherited and retained previous government arrangements. When ministerial responsibilities were split as a result of changes to leadership, they were soon joined together later. This shows that there was no obvious pattern in terms of preferences of the different parties in designating multiple responsibilities to ministers. This reflects Rose's (1990) *inheritance theory* which proposes that new governments tend to keep the policies and programs that they inherent from previous governments. This explains why departments and minister titles are shared by governments, reflecting commonalities between political parties.

Table 9.19 shows the current arrangements in terms of governments, parties in power and the government ministers and departments that are responsible for EWF matters. It also shows how the degree of integration across the states varies and how it also varies between ministerial responsibilities and government departments. While most states have some sort of partial nexus arrangement, both SA and WA governments show complete siloedness and separation of EWF.

The last column describes which matters need to be integrated. Each state has different arrangements. Energy and water are governed together in NSW at the ministerial level, Queensland at the ministerial level and department level and in NT at the ministerial level. Energy and food are governed together in the NT at both ministerial and department level. Water and food are governed together at the Commonwealth level at both ministerial level and department level, in NSW at the ministerial level and in Tasmania at both ministerial and department level. The table indicates that further integration is needed in order to achieve full integration of EWF so that EWF can be governed together.

Table 9.19: Current Arrangements for EWF

	Govt.	Ministers		Departments		Degree of nexus and scope for change
COM	Liberal-National Coalition	Min. Agriculture and Water Resources	W F	Dept. of Agriculture and Water Resources	W F	**Partial nexus** need to integrate energy with water and food
		Min. Environment and Energy	E	Dept. of the Environment and Energy	E	
		Min. Resources and Northern Australia	E			
NSW	Liberal	Min. Resources; Min. Energy and Utilities	E W	Dept. of Planning and Environment	E	**Partial nexus at ministerial level, Siloed at the departmental level** need to integrate energy and food at ministerial levels and integrate EWF at a departmental level
		Min. Primary Industries; Min. Regional Water	W F	Dept. of Primary Industries	F	
				Dept. of Industry	W	
VIC	ALP	Min. Resources	E	Dept. of Economic Development, Jobs, Transport and Resources	F	**Siloed at ministerial level, Partial nexus at the departmental level** need to integrate EWF and at the ministerial level to integrate food with energy and water at a departmental level
		Min. Energy, Environment, Climate Change	E	Dept. of Environment, Land, Water and Planning	E W	
		Min. Agriculture	F	Health Victoria	F	
		Min. Water	W			
QLD	ALP	Min. Natural Resources, Mines and Energy	E W	Dept. of Natural Resources, Mines and Energy	E W	**Partial nexus at ministerial level and at the departmental level** need to integrate food with energy and water at both ministerial and departmental levels
		Min. Agricultural Industry Development and Fisheries	F	Dept. of Agriculture and Fisheries	F	
				Dept. of Health	F	
SA	Liberal	Min. Energy and Mining	E	Dept. of Primary Industries and	F	**Siloed at ministerial level and departmental level**

	Govt.	Ministers		Departments		Degree of nexus and scope for change
				Regions SA (PIRSA)		need to integrate EWF at both ministerial and departmental levels
		Min. Primary Industries and Regional Development	F	Dept. of Environment and Water	W	
		Min. Environment and Water	W	Dept. of the Premier and Cabinet	E	
TAS	Liberal	Min. Energy and Resources	E	Dept. of State Growth	E	**Partial nexus at ministerial level and departmental level** need to integrate energy with water and food at the ministerial level and energy and food with water and food at the departmental level
		Min. Primary Industries and Water	W F	Dept. of Primary Industries, Parks, Water and Environment	W F	
				Dept. of Health	F	
WA	ALP	Treasurer; Min. Finance; Energy; Aboriginal Affairs	E	Dept. of Mines, Industry and Regulation and Safety	E	**Siloed at ministerial level, Siloed at the departmental level** need to integrate EWF at the ministerial level and departmental level
		Min. Regional Development; Agriculture and Food	F	Dept. of Water and Environmental Regulation	W	
		Min. Water; Fisheries; Forestry; Innovation and ICT; Science	W	Dept. of Primary Industries and Regional Development	F	
NT	ALP	Min. Essential Services	E W	Dept. Primary Industries and Resources	E F	**Partial nexus at ministerial level and at the departmental level** need to integrate water with energy and food at both ministerial and departmental level
		Min. Primary Industry and Resources	E F	Dept. of Environment and Natural Resources	W	
		Min. Environment and Natural Resources	W			
ACT	ALP	Min. Climate Change and Sustainability	E	Environment, Planning and Sustainable Development Directorate	E W	**Siloed at ministerial and partial nexus at the departmental level** need to integrate food with energy and water
		Min. Environment and Heritage	W	ACT Health	F	

Source: Author's compilation from data sources listed in Appendix D

9.1.3 Discussion and some reflections

The previous sections discuss how institutional settings have evolved over the five time periods, describing times when EWF were jointly governed as seen in decision-making and policy-making

structures, policies and legislation, in accord with the broader political environment and socio-economic context. The main points of discussion are:

1. Over the years, there is no evidence of any longstanding integration of EWF except for the period from the 1980s to the 1990s at the Commonwealth level. Only partial integration of EWF was mostly prevalent at the ministerial and department levels, with ministers and departments with cross-sectoral responsibilities serving for a number of years.
2. The integration of EWF was more apparent in the last two periods, from the 1970s to the present although current arrangements show very little integration in terms of portfolios, ministers and departments. While some cross-sectoral references are apparent in current policies and legislation, there are no fully integrated and comprehensive EWF policies or legislation.
3. The integration of EWF varied across jurisdictions. Integration appeared mostly in Victoria and New South Wales and in recent times in the NT and ACT (as a result of smaller ministries). The Commonwealth government also showed a degree of integration, particularly between all three sectors. WA, over the five periods, showed the least instances of integration between EWF.
4. In explaining the degree of EWF integration and differences across states, the influence of the political environment in terms of political parties and their preferences for integrated policy-making structures, policies and legislation, was not clear. In some states, integration was attributed to Labor parties and in others non-Labor parties. As mentioned, ministerial and department arrangements and policies and legislation were carried over despite changes in government and political parties.
5. In general, the extent of integration continues to reflect physical EWF linkages, driven by economic priorities, in particular, water and food linkages as well as water and energy linkages, highlighting the importance of water as an input in these sectors.
6. The analysis here, and in the previous chapters, shows that separation continues to exist at each institutional level examined. Together these highlight problems with the current institutions to properly deal with the interlinkages between EWF and essentially EWF security.

Some further reflections

a) The analysis of institutional settings has shown the extent to which EWF have been integrated according to each level of institution and their relationships. Much attention has been placed

on the formal institutional settings for EWF. Informal institutions have been discussed only to the extent to which they influence subsequent levels.

b) Development philosophies which have guided Australia's development have been characterised by shifts from 'colonial socialism', to Keynesianism, to neoliberalism; shifts towards multiculturalism and to an extent, environmentalism. They have impacted the definition of the role of EWF. They are underpinned by the values and attitudes held towards EWF.

c) It is apparent that over time, EWF have mostly been defined in terms of their economic roles, that is, their contribution to economic growth. Throughout history, EWF have been viewed as a means of economic development. The way in which EWF have been governed reflected a proclivity for exploiting EWF resources. More so under neoliberalist ideals, EWF are treated as commodities. Hence, the way in which EWF have been governed reflect their economic importance, with institutional settings geared toward maximising the growth that can be achieved through EWF. These institutional settings, however, can have negative implications on the long-term sustainability of EWF resources as they prioritise short-term goals that put pressure on resources, potentially worsening EWF security in the long-run. There is also a need to consider the social and environmental roles that EWF play in supporting the population and the natural environment and to align institutional settings accordingly.

d) Only in recent years has 'critical human needs' been part of the way in which water is framed while rising energy prices have highlighted the social impacts associated with energy as a household necessity.

e) The interlinkages between EWF in the five periods were mainly economic, limited by physical constraints. Neither have economic ideologies framed EWF as interconnected beyond the extent of their input relationships. This may explain why EWF have been dealt with separately. Changes in environmental ideologies have however played a role in highlighting the interconnectedness of EWF, environmental problems have revealed the limits of exploiting EWF and further, notions of natural resource management can promote nexus considerations. However, despite this, such highlight has not resulted in any perceptible shift in terms of governing EWF.

f) The extent to which interlinkages are considered can be attributed to a higher-level understanding of EWF which then informs subsequent institutional levels. As seen, government institutional settings reflect the economic priorities for EWF, seen in the primary industry and industry-focused portfolios. Policies have largely reflected economic objectives, similarly with pricing.

While the recommendations which follow focus on changes in formal institutional settings, considerations of informal institutions are acknowledged.

9.2 Recommendations

This section presents some recommendations for improving the state of integration between EWF decision and policy-making to implement a long-term nexus-based approach that more appropriately deals with the interconnected challenge of EWF security.

These recommendations are based on changes that the government could implement. While they are developed to better address inter-sectoral issues regarding EWF, many of these recommendations can be applied to address other inter-sectoral issues regarding other areas such as health, education or employment.

Improving the institutional settings for EWF concerns both horizontal integration and vertical integration. While horizontal fragmentation is implied with the concept of a siloed approach, as responsibilities are separated across sectors, it is also the vertical fragmentation that limits the possibility of integration between EWF as responsibilities are separated across multiple levels of governments. Vertical fragmentation largely is due to Australia's federalist government structure and decentralisation of responsibilities for EWF.

As observed in the previous chapters, the separation of EWF responsibilities and the lack of full integration comes from both horizontal fragmentation and vertical fragmentation with significant variations across the states. As a result, there is the potential for an unclear allocation of roles and responsibilities with potential overlap and duplication.

The recommendations discussed as follows seek to overcome horizontal and vertical fragmentation. They seek to strengthen the governments' capacity to deal with EWF challenges through: 1) clarification of its roles and responsibilities and 2) establishment of structures to support such roles and responsibilities and more importantly, with a focus on facilitating greater connection and collaboration between the sectors and those responsible. These recommendations aim to provide institutional settings for the joint governance of EWF.

9.2.1 Clarify roles and responsibilities

Clarity in the nature of the governments' roles and responsibilities is likely to influence the achievement of EWF policy goals and outcomes, particularly EWF security. Over the years, roles appeared to have been determined in an ad-hoc manner, in response to events in EWF sectors and according to the level of priority given to EWF matters. For example, attention to water has

usually corresponded with periods of droughts with less attention during periods of greater water supply.

The first recommendation concerns the clarification of roles and responsibilities with a view to pursue the integration of EWF policy development and implement joint-planning of the sectors. The benefit of clarifying roles and responsibilities was mentioned by the Management Advisory Committee (2004) stating that 'clearer division of responsibilities allows clearer lines of accountability and has important advantages in terms of efficient and timely delivery of services' (p. 105).

There is a need to streamline responsibilities, particularly across EWF sectors. As observed in the previous chapters, the scope of government in influencing EWF sectors has varied over time, involving varying levels of public and private sector involvement and varying across the levels of government.

Public and private involvement in policy and development, regulation and service delivery

The clarification of roles and responsibilities includes several steps. The first is to determine the responsibilities across EWF sectors in relation to policy, sector development, standard setting, regulation and service delivery, with a view to foster EWF integration. Clarifying these roles is required to meet each sectors' goals and objectives and ensure the efficient delivery of services and programs in each sector.

This will involve determining the appropriate mix of public and private involvement in each area and also along EWF supply chains. This should be done in consultation with industry, linking government with industry to determine the appropriate mix of public and private involvement. This is a prerequisite before allocating roles and responsibilities across government levels. Such clarification of roles and responsibility should first occur at the state level to account for specific conditions, such as geography and the physical linkages of the EWF characteristics of the state, state circumstances and the needs and interests of industries and constituents. The mix of public and private involvement is likely to vary across the sectors as a result of specific sector characteristics as well as across different states as a result of political beliefs and economic ideologies.

Public and private sector involvement has varied across EWF sectors, from the regulation of energy and water by independent regulators or government authorities, private retail provision of energy, competitive markets of food, to public involvement in the provision of water-related services. Policy, legislation and regulation are fundamentally government functions and not a

private sector function and therefore the question is about the extent to which the government should be involved and allowed to interfere in the sectors.

To foster integration between EWF sectors, governments will need to intervene through policy or regulation to encourage changes in behaviour that involve separate sector actors to consider their impacts on other sectors. This implies that government involvement will increase and sectors will be subject to potentially greater regulation. There will be a need for regulators (independent or government) to enforce new regulations.

Portfolio and government department responsibilities

Once roles and responsibilities are clarified and the level of government involvement is agreed on, with respect to each sector, the next step is then to ensure coherence across the roles and responsibilities comprising portfolios and of government departments. This is important to reduce problems of fragmentation of responsibilities across government departments and the potential duplication of roles and responsibilities that may lead to confusion by government departments. In order to foster integration between EWF sectors, centralisation of EWF policy responsibilities will be necessary to problems mentioned above.

Allocation of responsibilities across the levels of government

Next is the clarification of the roles across the multiple levels of government, within the constraints of the constitution. At the development of the constitution, the absence of allocation of EWF powers rendered such powers residual matters. Powers over EWF have not been clear-cut and have therefore relied much on interpretation.

While EWF matters are typically state matters, EWF responsibilities, regarding policy and development (direction setting), legislation (also standards setting), regulation (enforcement) and service provision, have however been shared across the tiers of government, with responsibilities assumed by Commonwealth, state and local governments. All levels of government have been involved in EWF matters.

Regarding regulation, government and independent agencies have been responsible for regulation, both at national and state levels. Agencies have included the Australian Consumer and Competition Commission (ACCC) (economic regulation) including the Australian Energy Regulator and other state agencies such as the Independent Pricing and Regulatory Tribunal of NSW and the Essential Services Commission of Victoria. Provision of EWF services, at the retail end, is governed by the public sector, mostly in the water sector and in some states electricity, and by the market in food and in some states in electricity and gas.

The level of vertical integration in terms of the integration between federal, state and local levels has differed across the sectors. With the National Water Initiative and other intergovernmental water agreements such as the Murray Darling Basin, there is some coherence between Commonwealth and state water sector objectives as well as harmonisation of goals across the states, guided by the National Water Initiative which acts as the national water policy. With a lack of a national energy policy encompassing all states and all energy-sector industries, there has been less integration between Commonwealth and state government energy policy and even less harmonisation of energy policies across the states. This is seen in the different state energy policies, particularly different energy-related climate change objectives and measures. While national agricultural policy and food standards exist, state policies are important to account for differences in agricultural industries between states (such could include differences in agricultural products and biosecurity risks).

Greater centralisation of EWF policies may enable opportunities for greater integration. For example, if national energy policy were formed and agricultural policy became more centralised at the Commonwealth level, such policies could be integrated with national water policies. It could be possible to integrate all national level EWF policies to promote integration and joint planning, with integration at the higher Commonwealth level. While this may be an option, there may also be trade-offs. Commonwealth integration of EWF policy may not necessarily reflect the integration and interlinkages between EWF policy at the state level and this may also cause incoherence and confusion. This implies that, while the Commonwealth does have scope to play a leading role in the integration of EWF Commonwealth policies, given its distance from governing state-specific EWF physical linkages, its role should be however limited to a high-level role. States should provide inputs to Commonwealth governments, based on their understanding and experience of EWF linkages and issues that affect them.

Such high-level responsibilities are needed to account for cross-jurisdictional matters such as transboundary water resources, including the Murray Darling Basin and the National Electricity Market (NEM). Rather than assuming full responsibility for EWF matters, the Commonwealth government would have an important role in coordinating and mediating between states concerning transboundary and cross-jurisdictional matters. The Commonwealth government, through the Council of Australian Governments, can play a greater role in supporting and promoting the horizontal integration of EWF at the state level. This role will be similar to the role it has played in other areas, for example, the National Competition Policy.

As mentioned, in relation to the integration of the EWF policies and the joint planning of EWF, the Commonwealth level should reflect integration processes carried out at the state and local levels, considering states also have important policy-making responsibilities. Integration at the

Commonwealth level should be in line with the states to not cause confusion or incoherence between what is supported at the higher level with that of the lower level. Drawing boundaries between Commonwealth and state policymaking may be difficult but will be necessary to reduce possible duplication. Constitutional change may be needed but is difficult to achieve.

While improvements may be made in reducing fragmentation and duplication of responsibilities by clarifying the roles and responsibilities, given the complexity of integrating responsibilities as a result of the variation between the roles of public and private sector and the roles of the different levels of government, challenges to integrate the institutional settings for EWF will remain. Overcoming the siloed approach to EWF matters depends on the coordination of these roles and responsibilities concerning the sectors and with respect to decisions made concerning the public and private involvement and the sharing of responsibilities between the levels of government.

9.2.2 Coordination and integration of EWF

The coordination of EWF roles and responsibilities and the need for fostering collaboration between those responsible for EWF reflects the horizontal integration between EWF. This is largely associated with the creation of inter-sectoral governance structures to address the separation of decision and policy-making between sectors.

The concept of working across portfolios and moving away from the 'siloed' mentality of government, however, is not new in the context of Australia. In 2004, the Management Advisory Committee (MAC) under the Howard government published a report titled *'Connecting Government'* discussing the importance of a 'whole of government approach' in the Commonwealth government, involving the need to work beyond portfolio boundaries. The report focussed on themes including structures and processes, changing culture, managing information, budget and accountability. Although there was limited success of the 'whole of government approach' in Australia (Australia Public Service Commission 2007)[25], the report however still provides principles that are relevant for dealing with inter-sectoral problems. Breaking the 'siloed' mentality and implementing horizontal governance or 'joined-up' government was recognised as an important issue in Australia as well as other Anglophone countries (UK, Canada and New Zealand) (Halligan, Buick & O'Flynn 2011).

With the need to consider the interlinkages between EWF, there is currently a greater need to implement principles of a 'whole of government approach' to overcome the existing siloed approaches. The EWF nexus and the challenge of redressing EWF security represent an area for

[25] According to the State of the Public Service Report 2006-07 (Australia Public Service Commission 2007), it was found that whole of government approaches were complicated, expensive and difficult to make work.

which a ‘whole of government approach’ can be applied. Enhancing the ability of the government to work across EWF sector boundaries hence is the main objective.

Current arrangements for governing EWF at the state level and to an extent at the Commonwealth level are siloed. At the Commonwealth level, EWF responsibilities are separated into the Agriculture and Water Resources portfolio and the Environment and Energy portfolio, represented by respective ministers and government departments.

In NSW, EWF responsibilities are separated into four portfolios, Resources, Energy and Utilities, Primary Industry and Regional Water. However, these four portfolios are represented by two ministers, one for Resources and Energy and Utilities and one for Primary Industry and Regional Water. Government departments include the Department of Planning and Environment responsible for energy, resources and mining which also takes into account agricultural impacts; the Department of Primary Industry responsible for agriculture, biosecurity and food safety, and the Department of Industry responsible for water under the Land and Water Division. Also responsible for water is the Natural Resources Access Regulator and the Office of Environment and Heritage. Responsibilities are allocated at the sub-department, divisional levels under the Departments with a wide scope of responsibilities. Departmental responsibilities however overlap.

In Victoria, EWF responsibilities are also separated into four portfolios; Resources; Energy, Environment, Climate Change; Agriculture; and Water, each represented by a separate minister. At the department level, energy and water responsibilities are the responsibility of the Department of Environment, Land, Water and Planning. The agriculture portfolio is supported by the Department of Economic Development, Jobs, Transport and Resources. Food safety is the responsibility of the Health Victoria, the state’s health department.

In Queensland, there are two portfolios, the Natural Resources, Mines and Energy portfolio and the Agricultural Industry Development and Fisheries portfolio, both represented by separate ministers. At the department level, the Department of Energy and Water Supply and the Department of Natural Resources and Mines have been combined to create the new Department of Natural Resources, Mines and Energy. Agriculture is the responsibility of the Department of Agriculture and Fisheries. Food safety responsibility belongs to the state’s health department.

In SA, there are three portfolios; Energy and Mining; Primary Industries and Regional Development; and Environment and Water, each represented by a separate minister. Energy is the responsibility of the Department of the Premier and Cabinet, under its responsibilities for services for business and community. The Department of Primary Industries and Regions SA looks after agriculture. The Department for Environment and Water is responsible for water.

In Tasmania, there are two portfolios for energy, Energy and Resources, represented by one minister and one portfolio, Primary Industries and Water, represented by one minister. The Department of State Growth is responsible for energy matters in the state including energy, markets, regulation, legislation, strategy and energy security matters. Water and agriculture are the responsibility of the Department of Primary Industries, Parks, Water and Environment. Food safety is the responsibility of the state's health department.

In WA, three ministers are responsible for EWF, a Minister for Energy, a Minister for Regional Development, Agriculture and Food, and a Minister for Water, Fisheries, and Forestry. Energy responsibilities are shared across departments including the Department of Mines, Industry Regulation and Safety and the Public Utilities Office of the Treasury. Water is the responsibility of the Department of Water and Environmental Regulation. The Department of Water and Environmental Regulation was established in 2017 and was a result of the amalgamation of the Department of Environment Regulation, Department of Water and the Office of the Environmental Protection Authority (WA Government Public Sector Commission 2017). Agriculture and food is the responsibility of the Department of Primary Industries and Regional Development.

In NT, three ministers are responsible for EWF matters, the Minister for Essential Services responsible for energy and water, the Minister for Primary Industry and Resources responsible for energy and food and the Minister for Environmental and Natural Resources also responsible for water. Energy and food is the responsibility of the Department of Primary Industries and Resources, whereas water is the responsibility of the Department of Environment and Natural Resources.

In the ACT, two ministers are responsible for energy and water, the Minister for Climate Change and Sustainability and the Minister for Environment and Heritage. At the Department level, water and energy are the responsibility of the Environment, Planning and Sustainable Development Directorate. Food is the responsibility of the state's department for health, ACT Health.

As observed in the previous chapters, the extent of coordination and integration observed between EWF policy has mostly been limited to the 'taking into account' end of the spectrum with 'dialogue' and 'joint-planning' on the other end (Halligan, Buick & O'Flynn 2011, p. 84). The objective of the following recommendations is to hence shift the current approach from one side of the spectrum to the other, thus improving the coordination and integration between EWF decision and policy-making.

Creation of inter-sectoral/ inter-departmental EWF committees

The previous chapters showed that ministerial responsibilities varied over time and across states, with few instances of ministers with combined EWF responsibilities. Given the current settings of ministerial responsibilities, the creation of a long-term inter-sectoral government committee could promote greater connection, collaboration and coordination of those responsible for EWF portfolios, without having to change current ministerial responsibilities or portfolios, that is, without having to change the current powers of incumbent ministers and create tensions, thus avoiding potential conflicts.

The creation of an inter-sectoral committee could bring together ministers responsible for EWF portfolios, the respective government department secretaries, and others carrying out work in each of the sectors, and to provide a platform to establish communication between those responsible and to implement a new culture of collaboration. It would enable those to begin developing an understanding and appreciation of common objectives and inter-sectoral issues. Such a platform could be used to discuss the potential impacts on other sectors and voice concerns about policies that may have negative impacts or raise ideas regarding the opportunities for which there may be policy synergies. At the state level, inter-sectoral committees covering EWF issues have existed. Table 9.20 lists examples of relevant past and present inter-sectoral committees. That table also indicates integration particularly in Queensland.

Table 9.20: Inter-sectoral Committees

State	Committee	Year start	Year end	Relevant matters
NSW	Standing Committee on State Development	1998	2015	Environment, Primary industry, Natural resources
	Standing Committee on Natural Resource Management (Climate Change)	2007	2008	Sustainable natural resource management, Climate change impacts, Land and water use
QLD	State Development Natural Resources and Agricultural Industry Development Committee	2018	Current	State Development, Manufacturing, Infrastructure and Planning Natural Resources, Mines and Energy Agricultural Industry Development and Fisheries
	Agriculture and Environment Committee	2015	2018	Agriculture, Fisheries and Rural Economic development Environment and Heritage Protection
	Agriculture, Resources and Environment Committee	2012	2015	Agriculture, Fisheries and Forestry Environment and Heritage Protection Natural Resources and Mines
	Environment, Agriculture, Resources and Energy Committee	2011	2012	Responsible for portfolios Minister for Energy and Water Utilities

				Minister for Main Roads, Fisheries and Marine Infrastructure Minister for Agriculture, Food and Regional Economies Minister for Environment Minister for Finance, Natural Resources and The Arts
	Public Works and Utilities Committee (formerly the Transportation and Utilities Committee, also formerly the Utilities, Science and Innovation Committee)	2015	2017	Main Roads, Road Safety, Ports, Energy and Water Supply Housing, Public Works and Sport Science, Information Technology and Innovation
	State Development, Infrastructure and Industry Committee	2012	2012	Infrastructure and Planning Energy and Water Supply
	Environment and Resources Committee	2009	2011	Environmental protection Climate change Land management Water security Energy
WA	Economic and Industry Standing Committee Economics and Industry Committee	2013 2001	2017 2013	State Development, Planning and Infrastructure Mines and Petroleum Fisheries Regional Development Lands Planning Energy Water Resources Agriculture and Food Forestry

Source: New South Wales Parliament website (2019), Queensland Parliament website (2019), Western Australia Parliament website (2019)

While informal relationships and networks may exist, the creation of such a committee could provide a means for formalising these relationships and ensuring that these relationships continue into future policy settings. This applies especially where there are separate departments and ministers responsible for EWF. The objective is to essentially establish communication between sector representatives, beyond what could be achieved via Cabinet processes to focus specifically on EWF matters.

Although short-term committees could be formed for specific inter-sectoral matters, a long-term committee that is open to a range of inter-sectoral matters is recommended. This would represent a cultural change in the way EWF matters are dealt with over the long term. While it may add further bureaucracy, it is seen as an important means of connecting otherwise separate decision

makers. This structure also recognises the need to preserve some degree of separation where sector-specific specialisation is required.

The creation of inter-sectoral government committees at the state level could eventually encourage the creation of inter-sectoral and intergovernmental committees at the Commonwealth level, for example, the creation of an inter-sectoral ministerial council at the COAG level which, as discussed earlier, does not currently exist.

These committees are horizontal structures suitable for the 'whole of government work' (Management Advisory Committee [MAC] 2004, p. 21). Reasons for utilising such committees include the fact that they represent formal arrangements which have traditionally been used for cross-sectoral coordination. Further, the committees facilitate negotiation and consensus-based decision-making. Another advantage of inter-sectoral departments is the participation of Cabinet ministers who have an understanding of the broader interests and policies of the elected government, ensuring that overall sector level goals and objectives are consistent with higher level goals and priorities (MAC 2004, p. 21).

Creation of task forces, joint teams, special frontier agencies and other agencies

Other horizontal structures which can be used as platforms for the 'whole of government' work, in addition to interdepartmental committees, to help with the carrying out of cross-boundary work. These include: task forces, joint teams, agency arrangements and frontier agencies, some of which can be useful for promoting integration between EWF (MAC 2004, p. 21).

Taskforces

Taskforces are typically formed with specific objectives and may include individuals other than government officials. They operate within a certain time limit and focus on solving joint (complex) problems. They, however, do not generally have a 'representative role' like ministerial committees and decision-making is not usually consensus-based but based on problem solving.

Interdepartmental partnerships: Joint teams

Joint teams comprise employees from two or more departments working together under the control of the relevant secretary (MAC 2004, p. 33). Joint-decision making occurs between managers, executives of departments and ministers where appropriate.

According to the report, one example of a joint team was the Natural Resources Management Team, a joint initiative of the Department of Agriculture, Fisheries and Forestry and the Department of the Environment and Heritage, established to deliver the National Heritage Trust and the National Action Plan on Salinity and Water Quality (NAP). This example also reflects the use of joint teams in dealing with joint agriculture and water issues.

Special-purpose agencies: frontier agencies

Special purpose agencies are generally those formed for the purposes of dealing with specific complex issues and are created outside the normal departmental structures. The Australian Greenhouse Office, was an example, responsible for a single issue relevant to a number of portfolios and sectors. In the context of integration between EWF, special purpose agencies would be those that are formed for specific nexus-related issues. Special purpose agencies could be formed to deal with joint EWF issues, for example, biofuel development, natural gas development, or irrigation issues. However, such agencies will only be specific to issues and do not encompass broader integration of EWF planning.

Creation of an inter-sectoral ministerial portfolio

The creation of an inter-sectoral ministerial portfolio, such as a mixed portfolio combining EWF responsibilities, could indeed result from the establishment of inter-sectoral ministerial committees or councils to better support the integration of EWF responsibilities and facilitate joint EWF planning. The creation of an inter-sectoral ministerial portfolio would also indicate the recognition that EWF are interlinked and that an appropriate means for dealing with EWF matters is to deal with them in an integrated manner. This would change the way in which the government frames EWF issues. Such a portfolio would be similar to the previous commonwealth portfolio of Primary Industries and Energy.

Allocation of the ministerial portfolio to a single minister

While this is one means of integration, it may put a great amount of pressure on a single person to manage all decision making, creating a heavy burden for a single minister. The effectiveness of implementing this recommendation, however, relies on the implementation of the following recommendation.

Creation of an inter-sectoral government department

It is likely that such a department would be a large department resulting from an integration of existing separate government departments to support the establishment of a single minister responsible for all EWF matters. The structure of such a department is important. Internal collaboration between perhaps separate EWF divisions may be needed to ensure that siloes do not continue to exist. A reason for favouring this recommendation and also the creation of inter-sectoral committees is that the debate amongst separate EWF representatives and those carrying out the work in EWF areas can happen at the departmental level and committee level, rather than at the Cabinet level, therefore consensus-building may take place earlier before policy proposals are discussed at the Cabinet level. As described, ‘changing portfolio responsibilities in an attempt

to ‘internalise’ an issue can simply shift the point at which coordination has to take place’ (MAC, 2011, p. 22). This could minimise potential tensions and conflicts that could arise from excluding other sector representatives and their input. There may be a greater potential to strike consensus in policy-making at the cabinet level.

9.2.3 Integrated policies and processes

Integrated policies

Integrated EWF policies will only be possible if collaboration is facilitated between otherwise separate EWF policy domains (as previously discussed). Such collaboration could also contribute to the formulation of new legislation to embed integrated thinking in policy decisions. Regular integrated assessments of EWF security could further support long-term integrated policy.

Pricing

There is a need to assess pricing structures as well as take into account externalities particularly related to the impacts on EWF. Similar to the above, efforts to take into account the costs of improving the security of EWF can only succeed if there is integration at the policy level. Changing pricing processes in isolation would only further distort prices.

An important element related to pricing involves investment. Providing incentives for investment to be channelled towards projects that are more energy efficient, water efficient and cause minimum land impacts and minimum impact on EWF security would also be beneficial. This could be achieved by developing new investment criteria, aligned with minimising EWF impacts, supported by incentives for investors. Financial incentives however may be costly and reliant on government funds.

Processes

Processes shaping EWF sectors also need to change. The development of criteria that consider impacts on security and focus on achieving inter-sectoral efficiencies will be required. For example, water planning processes could evolve to consider the impacts on energy and food security. Further, the integration of mining water rights within the water rights system would help to reduce the bias towards mining and extractive industry water use.

For electricity generation, procedures could be implemented to factor other water and food sector impacts. For example, in scheduling electricity generators, selection could be based on generators that minimise impacts on water and possibly agriculture. This would require electricity generators to report on water efficiencies. Appropriate incentives can be designed for dispatching schedules for generators that minimize water (and agriculture) impacts.

Inter-sectoral tools (modelling and analytical frameworks)

Inter-sectoral tools (modelling and analytical frameworks) could be formally employed to determine policy trade-offs arising from alternative policy pathways. One example, includes the input-output framework as a means of analysing the inter-sectoral linkages and their economic and social impacts. This would considerably benefit policymaking across various sectors, however, this would only be useful after formal networks between EWF interests have been established (as discussed above).

9.2.4 Consideration of other sectors – towards a 'whole of government' approach beyond EWF nexus

It is important that EWF are also not treated in isolation from other sectors of the economy and from other issues with which governments may want to deal. There will therefore be a need to incorporate feedback and consider the interest of other relevant sectors or portfolios such as health and environment to minimise wider negative impacts. EWF are after-all also linked to the wider economic, social and environmental context, and policies and new approaches to EWF will inevitably have implications on society and other sectors of the economy.

Because of the complexity of EWF security, the challenges for a single department or single minister in holding all EWF responsibilities are recognised. This is because doing so would require a diverse set of expertise in all fields of economics, science, health, environment and other areas. It is therefore suggested that in order to develop more appropriate settings to support EWF nexus-based policy-making, the focus should start with building dialogue between those currently working in siloes and creating a culture of cooperation before formal changes are made to the structure of organisations. This is the main priority for developing more appropriate institutional settings for EWF and only with such, integrated policy development across EWF would be possible.

9.2.5 Barriers

There are a number of potential barriers to implementing greater integration of EWF responsibilities, fostering collaboration and coordination to facilitate the joint planning of EWF sectors. These include the strength of lock-ins and path dependencies of existing, separated systems characterised by entrenched institutional cultures and power structures, and the extent to which the government is willing to fund the implementation of such changes. For example, where government departments have been typically siloed, a culture of competition rather than collaboration is likely to exist particularly between government departments that compete for their share of the government budget. The need to change or adopt new processes requires new skills

and expertise that may threaten jobs and this may cause resistance to changes in organisational and decision-making structures. Furthermore, changes in decision-making structures and processes may also result in loss of power and authority for some and this may also lead to resistance towards change.

The implementation of the above recommendations is likely to come at a cost, both in time, for instance, to reskill or train new people, and money to acquire additional resources. Implementing changes may also interrupt ongoing programs and policies which may also cause confusion and have negative impacts on programs if not managed accordingly. For such reasons, implementing change may not be in the interest of organisations, creating strong barriers to change[26].

Furthermore, it is also important to consider the long-term barriers, for example, whether new institutional arrangements to promote integrated thinking would endure in the long term; as whether changes in polity will result in a return to sectoral siloedness.

While changes in portfolios, the allocation of portfolios and the establishment of government departments are the norm, particularly with changes in elected governments, conscious effort must be made to integrate EWF planning to ensure that integrated structures and processes endure. This will require obviously bipartisan support.

Such shifts towards a nexus-based approach to EWF will inevitably represent a cultural shift in thinking. This will certainly create tensions between Commonwealth, state and local governments where objectives and capacities to meet objectives differ.

The development and emphasis on common objectives and common principles can help to support cultural shift. For example, principles of the Ecological Sustainable Development helped to instil new values and consideration of environmental impacts, which, during the 1990s, had influenced policy. A similar development of principles to support EWF integration will also be needed. One of the key driving principles and objectives is the continued improvement of EWF security through policies, legislation and organisational arrangements that mutually reinforce the achievement of the security of all sectors simultaneously through an understanding of interlinkages, trade-offs and synergies.

Difficulties in communication will also arise as a result of the distinct and specific sector language and jargon, where information presented will need to be simplified in order for others to comprehend. A common language needs to be formed so that those from different EWF sectors can understand each other and this would further help in the development of common goals. The

[26] A discussion of the challenges of institutional change in particular transaction costs is provided in *Section 3.4.2 The role of institutions in redressing EWF securit*y on pages 107-108.

distinct features of each sector also mean that skills and expertise are likely to also be distinct. Hence, coordinating those of different backgrounds will also likely be a challenge.

While there is a role for legislation in ensuring continued integration and collaboration, as seen in previous legislation regarding the membership of councils and committees, developing informal relationships before imposing formal relationships may enable new institutions to have a greater chance of prevailing in the future.

9.3 Conclusions

This chapter has provided a synthesis of the findings in previous chapters, combining the findings of each of the four institutional levels and analysing how institutional settings for EWF have evolved across all levels, jurisdictions and over the five time periods.

- The main finding is that, in general, while awareness of integrating EWF has been evident for a long time, as noted in decision-making and policy-making structures (portfolio representation, ministerial and organisational responsibilities) over the past years, relatively few instances exist where such integration has reflected a consideration of mutual interdependencies between EWF, and where such consideration has actually influenced policy settings and outcomes. The overall institutional settings are replete with examples of a near-complete separation of EWF domains across jurisdictions.
- Further, across levels (Levels 1 to 4), integration has varied from greater integration at one level (for instance, the ministerial level) to much lower integration at another level (for example, pricing).
- Integration of EWF has also varied over time and across jurisdictions. On one hand, states such as Victoria and New South Wales have numerous instances of integration, while other states such as Western Australia show high proclivity for siloed approaches.
- Further, while there have been some differences in the levels of integration of EWF across governments of different political persuasions, in general, no specific party has been found to particularly support integrated policy thinking. The extent of integration of EWF has been mostly due to state economic factors rather than political differences.
- Current arrangements for EWF vary across the states. They are quintessentially siloed, notwithstanding some instances of integration of institutional settings. Therefore, there is considerable scope for the integration of institutional settings.

This chapter also provided some recommendations for facilitating the integration of institutional settings for EWF. The emphasis is on clarifying responsibilities of government across sectors and across the levels of government; and on coordination, describing ways to facilitate

communication between sectors and a breaking down of ‘siloes’ to implement joint policy and decision making (e.g. through establishment of inter-sectoral bodies, development of common principles and modelling tools for analysing integrated policy). The ultimate goal is to develop more appropriate institutional settings that provide a means for EWF to be governed jointly, with consideration of their interdependencies.

Chapter 10 Conclusions and suggestions for further research

The pursuit of economic growth, modernisation and rising living standards is increasingly putting pressure on the planet's natural resources that sustain life, and continuing environmental degradation, resource depletion and climate change are compounding the problem. One area of significant concern is the security of energy, water and food (EWF), the most fundamental basic needs, intrinsic to human survival and development. As discussed in this research, ensuring EWF security is an issue faced by both low and high-income countries, including Australia.

Redressing EWF security issues, however, is a challenge and this is because EWF are inextricably linked (EWF nexus). Understanding about the nature of such (i.e. EWF nexus) is a prerequisite for redressing EWF security; this has been a key focus of this research.

The primary objective of this research is to develop an institutional perspective on the EWF nexus in the context of Australia, with a view to inform policymaking to redress EWF security. Attention to the institutional dimensions of the EWF nexus in the literature has largely been limited. This research contributes to the body of knowledge about this dimension.

Through an institutional perspective, this research develops an appreciation of the important role that institutional settings play in effectively governing EWF and hence contributing to a satisfactory redress of EWF security. An understanding of institutional settings and their transformation over time is essential for understanding how to improve the governance of EWF. The emphasis is on the need for policymakers to incorporate greater consideration of the interdependencies between EWF (and underlying trade-offs and synergies) into policies intended to achieve EWF security[27].

[27] Given the importance of EWF security across the globe, the issues investigated apply beyond the Australian context as the need for institutional settings to provide the means for countries to deal with the EWF nexus is not limited to Australia. The need for appropriate institutions is particularly important for developing countries where EWF security may be more fragile and where institutional settings for EWF may not be fully established. This research could hence stimulate debate in other country contexts about EWF institutions which could lead to the design and timely implementation of more appropriate institutional settings for countries in the development stage of their economy and EWF sectors.

To achieve the sub-objectives of this research, a framework based on a Levels of Institutional Analysis was developed for Australia. This involved examining the historical evolution of the country's institutional settings for EWF over the past hundred years or so. These institutional settings were reflected in the Levels of Institutional Analysis framework that covered both informal (development philosophies) and formal (government, policy, rules, organisations, pricing processes and other sector arrangements) institutions as well as their relationships. This research contributes to knowledge through the development of a framework to analyse the institutional settings of the EWF nexus for governing EWF. The theoretical contribution is in the approach for analysing institutions for cross-sectoral governance, an area for which current understanding is limited. The research is the first of its kind to analyse institutional developments of EWF simultaneously in the context of Australia.

The main conclusions are presented below followed by suggestions for further research.

10.1 Conclusions

Evolution of EWF

The five time periods described in the historical overview covered the formative stages of Australia's development from the colonial settlement, the federation of states and the country's experience through times of war, economic recovery, economic reform, up to the present. The main points are as follows:

- Early developments in the EWF sectors took place during the colonial settlement, characterised by developments in mining and agriculture that were essential for the economic prosperity of the country. It was also a time which saw the development of water supply, sewerage and electricity systems to support the growth of towns and cities. Challenges of securing water were felt during this period and gave rise to the beginning of water control with government intervention and the introduction of irrigation to support rural expansion.
- A key theme from the federation period to the post-war period was the high level of government involvement in driving economic development. Protectionist policies aimed to ensure the growth of industries, particularly agriculture. Both Commonwealth and state governments played an important role in EWF sectors. The establishment of large statutory authorities and agencies across the states to govern water, electricity and agricultural production indicated the high levels of government involvement during these periods.
- During the 1970s, the Australian economy underwent a significant shift from its interventionist approach to economic growth of the previous periods to a neoliberal approach. Economic reforms were implemented in a number of sectors with the objective of improving

competitiveness to better adapt to the global economic system and exposure to greater market forces.

- Significant segments of EWF sectors underwent economic reform. Many of the earlier reforms in the energy sector involved the corporatisation, commercialisation and in some cases privatisation of many of the government business enterprises responsible for electricity generation and gas. Later, reforms in the energy sector involved structural reforms, such as the vertical functional unbundling of the supply chain, the separation of generation, transmission, distribution and retail units and the development of the National Electricity Market. Water sector reforms involved the introduction of water markets, water allocation, water pricing and measures to incorporate environmental considerations in water sector development. In the agricultural sector, reforms included a gradual phase-out of protective measures and statutory marketing arrangements, signalling a reduction in direct government control and involvement in a number of rural industries.
- Despite a winding back of (direct) government involvement, the Commonwealth government continued to play a prominent role through national policy-making and the establishment of the Council of Australian Governments (COAG). Much policy was developed through intergovernmental coordination and cooperation. Both periods saw EWF issues addressed at the national level.
- The evolution of EWF sectors has been eventful and complex. Each sector evolved according to sector-specific drivers of change (for example, water scarcity in the water sector) as well as broader drivers of change (such as economic reform and ecologically sustainable development). While differences in the characteristics of EWF have meant differences in their development trajectories (for example, in the context of water, environmental outcomes were increasingly more important than in other sectors), other considerations (e.g. broad interests, associated with the wider economic, social and environmental agenda), also influenced EWF trajectories.
- The roles of EWF sectors, as seen in the first three periods, reflected their dual nature, namely serving the basic needs of the population as well as contributing to economic growth, in which the governments (Commonwealth and state) were highly involved. In the following periods, up until the present, the dual role of EWF sectors has persisted, despite the shift towards a market economy. Heightened environmental concerns, however, have also influenced these sectors by creating an imperative to incorporate environmental considerations in their mandates.
- The historical overview provided in this research has highlighted changes in the way EWF have been governed through formal institutions, as reflected by the changes in development philosophy (informal institutions), from one supporting high levels of government

involvement to manage socio-economic matters, to one supporting an appropriately arms-length approach by the government. The government has played and continues to play an important role in EWF sectors. As basic needs, a continued role for government is still required, particularly as contemporary challenges such as energy security challenges and climate change challenges continue to impact the country.

Institutional integration of EWF

Against the backdrop of Australia's historical development since colonial settlement to the present, the analysis of the institutional settings of EWF through the *Levels of Institutional Analysis* framework revealed the extent to which EWF have been governed jointly over time and how these institutional settings have evolved. The development of a hierarchy of institutional settings into four levels, and an understanding of their relationships, highlighted the complexity of governing EWF. The four levels examined to measure the integration between EWF included: government's capacity to influence EWF sectors, its decision-making and implementation structures, the resulting policy outputs and the overall guiding philosophies. The main conclusions are presented below.

Development philosophies and government involvement

- Level 1 institutions looked at the development philosophies that have shaped Australia's socio-economic development. The change in development philosophies, particularly from colonial socialism, Keynesianism to neoliberalism had implications for the government's involvement in EWF sectors while changes in environmental awareness influenced EWF developments as observed in objectives to reduce greenhouse emissions and address the environmental impacts of water exploitation.
- Level 2 institutions looked at the government (its functions and characteristics), including intergovernmental relations (financial dependency and intergovernmental coordination) and government involvement (centralisation, private and public mix, government responsibilities), showing the capacity governments have in influencing EWF sectors and how this varies across jurisdictions.

    - Financial dependency of the states on the Commonwealth Government enabled the Commonwealth to indirectly influence state matters, particularly in water, which it did through state grants.
    - Intergovernmental coordination between the tiers of governments has become an important feature of policy-making and implementation, particularly in EWF. This was seen in the number of intergovernmental agreements and ministerial councils particularly dealing with

EWF. Integration between EWF however is lacking as coordination and cooperation mostly occur on a sector-by-sector basis. There was little evidence of inter-sectoral and intergovernmental coordination in EWF policies and approaches.

- Government involvement in EWF sectors has varied over the five time periods and across the states, indicating changes in the scope governments had to influence the sectors and in particular, to influence integration between sectors. After federation, increasing levels of government involvement were evident in EWF sectors, as seen in the centralisation of electricity and water sectors (originally local government and private concerns) and the dominance of the Commonwealth government. While agriculture and mining sectors were predominantly state government concerns, the most changes in government involvement were seen in the electricity and water sectors. Although the centralisation of electricity and water enabled the levels of government involvement in EWF sectors to converge, by raising the scope that governments had to influence EWF sectors, they soon diverged. Economic reforms reduced the direct involvement of government in electricity and food sectors; in some states, electricity was privatised, limiting the scope of governments to influence electricity operations. The provision of services was no longer a government responsibility. As a result, the capacity of governments to influence integration between EWF declined and has since been limited. The more minimal the role of government in a sector, the less scope it has to encourage integration.
- The differences in involvement across the tiers of governments (Commonwealth, state and local) and the sharing of EWF responsibilities, this research has demonstrated, may however cause confusion of roles, leading to possible overlaps and inefficiencies. This research also demonstrated that the scope of responsibilities at each level was not clear. Further, the Commonwealth government, despite having no formalised responsibility specified in the constitution nonetheless played a greater role in EWF. This has contributed to tensions between Commonwealth and state governments.

Portfolios, Ministers and Departments

- Government portfolios, ministerial responsibilities and organisations (government departments) at Commonwealth and state levels indicated the extent to which responsibilities were integrated.
- Both partial (energy-water, energy-food, water-food) and full (energy-water-food) integration was evident over time. Notwithstanding the improvement in overall integration over the time periods, current arrangements however are mostly siloed. Integration has also varied across jurisdictions. For example, the longest number of years served by a minister and department

with cross-sectoral responsibilities was in Victoria. The least number of years served by a minister or department with cross-sectoral responsibilities was in WA.

- The relationship between portfolios, ministerial responsibilities and departmental responsibilities was important to consider the overall extent of integration. For example, siloedness at one level, particularly at the portfolio level, was often compensated by integration at the ministerial level. Similarly, siloedness at the ministerial level was also at times compensated by integration at the department level.
- Variations in integration across portfolios, ministerial responsibilities and department responsibilities showed how integration between EWF is supported throughout the decision making and implementation chain, for example, whether there were departments with cross-sectoral responsibilities to support ministers with cross-sectoral responsibilities. Asymmetries between ministerial and departmental responsibilities showed that integration was often weakened. While integration between EWF was most evident at the ministerial level, at times, ministers were not supported by departments with the same cross-sectoral responsibilities.
- Current arrangements show very little integration of the three EWF areas, suggesting that the current configuration of portfolios, ministerial responsibilities and government departments are inadequate and unable to support a nexus-based approach to policymaking. There is therefore scope for further integration between EWF responsibilities. Currently, most integration is seen in the Territories, perhaps explained by the existence of smaller ministries and fewer ministers who are often made responsible for multiple portfolios.

Policy, legislation, pricing and other sector arrangements

- EWF policies including some of the broader economic and environmental policies, showed some integration of EWF as often policies referred to other sectors, including the importance of linkages. Such references to linkages included, for example, the importance of water security for agriculture, which was also an important consideration and constraint regarding the development of unconventional gas (reflecting EWF linkages), and the role of both water and agricultural sectors to improve energy efficiency and hence reduce emissions, particularly relevant for the agricultural sector. Most references to other sectors, however, were often very minor.
- No policies appeared to reflect a fully integrated EWF policy approach and most policies regarding EWF were sector specific. Broader economic and environmental policies were those that had scope over all EWF domains. At the state level, policies for EWF were tied to broader economic and environmental objectives.
- EWF legislation and regulation also revealed little connection between EWF. Legislation tended to be mostly sector specific, dealing with sector-specific details and issues. Links

between EWF were less obvious. Environmental legislation, such as the Natural Resource Management Act 2000in SA, was one example of state legislation that considered EWF linkages in the context of natural resource protection. The 'water trigger', a feature of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), was another example that reflected important considerations for energy production and use-related impacts on water resources and the indirect impacts such would have on land and thus agriculture. This demonstrated the role of environmental legislation in regulating the negative impacts of energy, water and land resource use on the resources themselves.

- Pricing processes showed almost no integration between EWF, with no provisions for incorporating externalities associated with the impacts of EWF resource use or impacts on EWF security. During periods of fixed pricing, it was not clear whether inter-sectoral linkages were taken into account. Priorities for pricing were mostly associated with cost-recovery principles.
- The lack of integration between EWF, evident in both Level 3 and Level 4 institutions, could be correlated with the lack of integration inherent in the higher institutional levels (portfolio, ministerial and organisational levels). However, this did not entirely explain integration at the policy level. For example, at the Commonwealth level, while portfolio, ministerial responsibilities and organisations were largely separate during the Gillard Labor government, policies at the time appeared to consider EWF linkages, although no policy was fully integrated and policies were still essentially sector-based.
- In general, there was no evidence of a fully integrated and comprehensive EWF policy. There was no evidence of any longstanding integration of EWF at the portfolio, ministerial and organisational level. Separation was more apparent than integration at this level.

All institutional levels

Considering all institutional levels:

- Over the years, there is no evidence of any longstanding integration of EWF, except for the period from the 1980s to the 1990s at the Commonwealth level.
- While integration of EWF has been more apparent in the last two periods, from the 1970s to the present, current arrangements show very little integration in terms of portfolios, ministers and departments, and while some cross-sectoral references are apparent in current policies and legislation, there are no fully integrated and comprehensive EWF policies or legislation.
- The integration of EWF varied across jurisdictions. Integration appeared mostly in Victoria and New South Wales and in recent times in, Northern Territory and Australian Capital Territory (as a result of smaller ministries). The Commonwealth government also showed a

degree of integration, particularly between all three sectors. Western Australia, over the five periods, showed the least instances of integration between EWF.

- In explaining the degree of EWF integration and differences across states, the influence of the political environment in terms of political parties and their preferences for integrated policy-making structures, policies and legislation, was not clear. Both parties were responsible for integrated policy-making structures and policies. In some states, integration was attributed to Labor parties and in others non-Labor parties. As mentioned, ministerial and department arrangements and policies and legislation were carried over despite changes in government and political parties.
- Policies, legislation, pricing and the decision structures underpinning EWF have not been well integrated, and although not completely siloed, they still show a high degree of separation, thus requiring further integration. Separation exists at each institutional level examined. Together these highlight problems with the current institutions to properly deal with the interlinkages between EWF and hence EWF securities.
- In general, the extent of integration continues to reflect physical EWF linkages, such as water and food linkages, that originated since early development, to ensure water for food production.
- It is apparent that over time, EWF have mostly been defined in terms of their economic roles in contributing to economic growth. Throughout history, EWF have been viewed as a means of economic development, and consequently the way in which EWF have been governed has reflected a proclivity for exploiting EWF. The interlinkages between EWF were mainly economic, limited by physical constraints. Neither have economic ideologies framed EWF as interconnected beyond the extent of their input relationships. This may explain why EWF have been dealt with separately. Changes in environmental ideologies have however played a role in highlighting the interconnectedness of EWF as environmental problems have revealed the limits to exploiting EWF.

- The main finding is that, in general, while awareness of integrating EWF has been evident for a long time, as noted in decision-making and policy-making structures (portfolio representation, ministerial and organisational responsibilities) over the past years, relatively few instances exist where such integration has actually influenced policy settings and outcomes. The overall institutional settings are replete with examples of a near-complete separation of EWF domains across jurisdictions. Further, across levels (Levels 1 to 4), integration has varied from greater integration at one level (for instance, the ministerial level) to much lower integration at another level (for example, pricing). Integration of EWF has also varied over time, and across jurisdictions. On one hand, states such as Victoria and New South

Wales have numerous instances of integration, while other states such as Western Australia show high proclivity for siloed approaches. Further, while there have been some differences in the levels of integration of EWF across governments of different political persuasions, in general, no specific party has been found to particularly support integrated policy thinking. The extent of integration of EWF has been mostly due to state economic factors rather than political differences. Current arrangements for EWF vary across the states. They are quintessentially siloed, notwithstanding some instances of integration of institutional settings. Therefore, there is considerable scope for the integration of institutional settings.

Towards a nexus-based governance approach to EWF

Current arrangements for EWF across the country indicate there is further scope for the integration of institutional settings for EWF. Instances of full integration in the past signals that this is possible. Efforts to further integrate institutional settings for EWF to capture all three EWF domains however must carried out with a long-term objective to introduce and sustain such integration and this is only possible with the recognition that governing EWF jointly is essential to avoid the potential negative outcomes that result from EWF interactions. Further integration will require a re-framing of EWF as interconnected, rather than separate policy matters where EWF policy goals interact, with consideration of the broader socio-economic and political objectives that may also need to evolve. This will not be easy as policy makers will need to adjust to more complex organisational networks and decision-making structures that accommodate greater coordination and collaboration between those responsible, for and influential to, EWF developments. As a result, achieving full integration of institutional settings for EWF is likely to happen gradually. Acknowledging the above, some recommendations include:

- The clarification of roles and responsibilities for those currently responsible for EWF with an understanding of what is required for each sector;
- Appropriate allocation of responsibilities across levels of government with decisions to be made on centralisation and decentralisation;
- Development of inter-sectoral bodies to coordinate decision-makers and implementation entities for EWF including ministerial committees, super-departments or special task forces, with bodies to coordinate across levels of governments including inter-governmental councils; and
- Reviving the principles of the ‘whole-of-government’ approach in the Australian context, to foster a cultural change and an integrated approach to tackle interconnected national issues, particularly EWF security.

Potential barriers to integration (as mentioned above) are reflected in the need to fundamentally change the thinking and culture of dealing with interconnected issues that are otherwise seen as separate. Only with such change is further integration possible. Integrated policies, rules, pricing and other sector arrangements will result when greater coordination is achieved. Facilitating communication between sectors and a breaking down of 'siloes' to implement joint policy and decision making is a prerequisite.

Pressures may arise from economic and political objectives to separate EWF to meet growth goals so it is necessary that the integrated governance of EWF is not undermined by short to medium term changes (for example, a change in government). Therefore, bipartisan support is also required, however difficult to achieve particularly in the context of energy. The more enduring institutional settings are for governing EWF jointly, the greater the opportunity to redress EWF security challenges. The ultimate goal is to develop more appropriate institutional settings that provide a means for EWF to be governed jointly, with consideration of their interdependencies over the long-term.

10.2 Suggestions for further research

This research developed an institutional perspective on the EWF nexus with a view to inform policy-making to redress EWF security. Institutional settings for governing EWF were examined with an emphasis on identifying the extent to which EWF have been governed jointly, either reflecting an integrated, nexus-based approach or a siloed approach. The *Levels of Institutional Analysis* framework developed in this research provide a means for examining these institutions at the country level and was applied to develop an in-depth case study on Australia.

As one of the first studies to comprehensively examine the institutional settings for EWF for one country over a long period with a framework specifically developed to analyse integration of EWF, there is scope for further improvements in the overall analysis. Furthermore, in light of the limited attention given to the institutional dimensions of the EWF nexus (as noted in Chapter 2 of this research), there is great scope for further research.

Application of the Levels of Institutional Analysis Framework to examine the cross-sectoral governance of EWF

Quantitative analysis

The analysis in this thesis essentially sought to qualitatively examine the cross-sectoral governance of EWF over time as indicated by the institutional settings for EWF.

Further research could involve the development of quantitative approaches. For example:

- Development of a metric that quantitatively measures the degree of integration reflected in each institutional component and level over time, indicating siloedness, partial integration of two sectors and full integration.
- Examination of the relationships between the levels of EWF institutional settings, using correlation and causality analysis, to quantitatively analyse how the degree of integration at one institutional component may influence integration at another level.
- Analysis of the relationship between EWF institutional settings on actual outcomes of EWF security in Australia. This would also involve quantifying the outcomes of EWF security through the development of composite indices to capture multiple attributes of EWF security such as accessibility, affordability, availability and sustainability. Further regression analysis could be used to measure the relationship between EWF institutional settings and EWF security.
- Further analysis of multiple level relationships between institutional levels and effects on EWF security could involve more advanced econometric approaches that employ, for example, Granger causality testing, mixed effect models and multi-level regression models.

To carry out the statistical analysis, the temporal scope may need to be reduced to cater for the availability of EWF data that has been mostly available only since the 1970s. An important consideration when undertaking such analysis is the time-lag between the development of policies, the enactment of legislation, the changes in ministers and department, leaders and political parties and the EWF security outcomes.

The above quantitative approaches could also be used to examine the differences and similarities between states, including a comparison of each state and relationships between states, for example, measuring how larger states may influence smaller states or how performance at the Commonwealth level influences performance at the state level.

Qualitative analysis

There is also scope for refining qualitative research approaches. This may involve, for example, working with government officials to understand the extent of EWF integration that occurs in the field. This could include interviews and workshops with those in EWF government organisations, to map informal networks between EWF organisations, and to identify any internal procedures that may facilitate inter-sectoral cooperation.

In-depth analysis at each level

Further analysis could also be undertaken at each level at a greater depth. For example,

- Analysis of Level 1 institutions could be carried out in more depth, for example, to develop a cultural perspective on EWF, focussing on cultural customs and social attitudes towards energy, water and food in Australia or in another country context;
- Analysis of Level 2 institutions could include an examination of budgets for, and investments in EWF over time; an analysis of the trade-offs of centralising control and the benefits and costs of government ownership; and the effectiveness of independent regulation;
- Analysis of Level 3 institutions could include a more focussed examination of specific policy and legislative issues and the extent to which the EWF nexus is recognised and whether organisations are capable of supporting integrated policy implementation. A specific issue could include renewable energy policy or unconventional gas development;
- Analysis of Level 4 institutions could include the identification of different types of institutions, in addition to pricing processes; and
- Analysis could be conducted to investigate the impact of higher-level institutions in relation to the specific behaviour of individuals and specific groups and how this influences, for instance, their consumption of EWF. This thesis, however, limits its scope to understand the nature of higher-level institutions and leaves such micro-level analysis for future research.

Scale of analysis

The scale of analysis can also be varied. For example, the scale can be narrowed to develop a local government perspective as well as an in-depth perspective of each state, and like other studies, an analysis of a particular region, for example, the Murray-Darling Basin (as seen in other transboundary water basin studies) or the region covered by the National Electricity Market.

It is possible to replicate the analysis undertaken in this research in other country contexts to investigate similar questions regarding institutional settings for EWF challenges. Furthermore, the application of the framework to different countries could enable the development of a cross-country study which considers the differences in institutional settings across countries with differences in:

- EWF security challenges: for example, countries with high energy import dependence, food import dependence, low energy access, low access to clean water;
- Geographic characteristics: comparing countries that are resource-rich or resource-poor, water scarce or water abundant, countries with large areas of fertile land compared with those with small areas of fertile land;
- Economic development: comparing countries at different stages of economic development with different incomes, thus correlating institutions; EWF security outcomes and economic growth and development;

- Political environments and systems: comparing countries with different or similar government structures and political systems, for example, other federal democracies or those with authoritarian regimes; and
- Culture and society: cultural beliefs and perceptions about EWF, informed by societal factors, traditions or religious beliefs.

The analysis can be used to develop a regional perspective, grouping countries according to continents or sub-continents and more so, to develop a global perspective, perhaps demonstrating lessons to be learnt by countries dealing with similar issues from countries dealing successfully with their EWF challenges by considering EWF interlinkages.

Scope of analysis

The framework developed can also be applied to analyse other issues where interconnections exist between several domains, similar to the EWF nexus, for example, whether institutional settings provide a means for labour, health and education areas to be governed together. Other interrelated areas could also include industry, infrastructure and environment. The framework can be applied to the analysis of other interconnected issues of government concern.

There are several opportunities for further research to overcome the limitations of this research as well as to extend the research. This research provides the foundations for analysing similar questions for which an examination of institutions can provide insights to inform more improved policy as well as enable the improvement of institutional settings.

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Appendix A. Energy and water consumption and intensity statistics

Table A1. Energy consumption (PJ) of energy, water and food sectors 2015-2016

	2015-16	% share of total consumption	% share of sector consumption	Growth since 2008-09 (%)	Growth since 2008-09 (% average annual)
Energy Sector	**2 244.3**	**37%**		**-2%**	**0%**
Coal Mining	127.5	2%	6%	52%	6%
Oil and gas extraction	292.7	5%	13%	67%	8%
Petroleum refining	86.3	1%	4%	-19%	-3%
Other petroleum and coal product manufacturing	10.1	0%	0%	32%	4%
Electricity supply	1 727.7	28%	77%	-10%	-1%
Gas supply	10.2	0%	1%	0%	0%
Water Sector	**16.0**	**0.3%**		**18%**	**2%**
Water supply, sewerage and drainage services	16.0	0.3%	100%	18%	2%
Food Sector	**270.8**	**4%**		**27%**	**3%**
Agriculture, Forestry and Fishing	109.8	2%	41%	17%	2%
Food, beverages and tobacco	161.0	3%	59%	34%	4%
Total consumption of EWF sectors	**2 531.1**	**42%**		**0.2%**	**0.0%**
Total consumption	**6 081.3**			**4%**	**1%**

Source: Energy Consumption Data sourced from the Department of Environment and Energy 'Energy Statistics 2018, Table F.

Note: Although energy consumption data for 2016-17 is available, data for 2015-16 is used to enable comparison with most recent water consumption data. Earliest water data is from 2008-09 which explains comparison from this year. Energy sector includes coal mining, oil and gas extraction, petroleum and coal product manufacturing and electricity and gas supply. Water sector includes Water, sewerage and drainage sector while the Food sector includes Agriculture, forestry and fisheries (Forestry is not separated) and Food, beverage and tobacco manufacturing.

Table A2. Water consumption (ML) of energy, water and food sectors 2015-2016

	2015-16	% share of total consumption	% share of sector consumption	Growth since 2008-09 (%)	Growth since 2008-9 (% average annual)
Energy Sector	**525 751**	**3%**		**-1%**	**0%**
Coal Mining	135 529	1%	26%	35%	4%
Oil and gas extraction	26 072	0%	5%	-30%	-5%
Petroleum, coal, basic chemical and chemical product manufacturing	76 275	0%	15%	15%	2%
Electricity and gas supply	287 875	2%	55%	-11%	-2%
Water Sector	**2 013 810**			**-13%**	**-2%**
Water supply, sewerage and drainage services	2 013 810	12%	100%	-13%	-2%
Food Sector	**9 880 811**	**61%**		**30%**	**4%**
Agriculture, Forestry and Fishing	9 604 085	60%	97%	31%	4%
Food, beverage and tobacco product manufacturing	276 726	2%	3%	0%	0%
Total consumption of EWF sectors	**12 420 372**	**77%**		**19%**	**3%**
Total consumption	**16 131 935**			**15%**	**2%**

Source: Water Consumption Data sourced from the Australian Bureau of Statistics Water Account 2015-216.

Table A3. Energy intensity and energy productivity 2015-16

	Energy intensity GJ/$m	Energy productivity $m/PJ
Energy Sector	**31837**	**31.4**
Coal mining	8009	124.9
Oil and gas extraction	11769	85.0
Petroleum and coal product manufacturing	63000	15.9
Electricity supply	65906	15.2
Gas supply	4487	222.9
Water Sector	**1214**	**823.9**
Water supply, sewerage and drainage services	1214	823.9
Food Sector	**4802**	**208.3**
Agriculture, forestry and fishing	3621	276.1
Food, beverages and tobacco	6174	162.0

Source: Department of Environment and Energy, 2018 Australian Energy Statistics Table F Australian Energy Consumption, by state, by industry and fuel type and energy units, ABS Australian Industry 2016-17 cat. 8155.0

Note: Intensities and productivities are based on Industry Value Added figures.

Table A4. Water intensity and water productivity 2015-16

	Water intensity ML/$m	Water productivity $000/ML
Energy Sector	**7.4**	**134.7**
Coal Mining	8.5	117.5
Oil and gas extraction	1.0	953.8
Petroleum and coal product manufacturing	49.9	20.1
Electricity gas supply	11.0	91.1
Water Sector	**152.8**	**6.5**
Water supply, sewerage and drainage services	152.8	6.5
Food Sector	**175.3**	**5.7**
Agriculture, forestry and fishing	316.9	3.2
Food, beverages and tobacco	10.6	94.2

Source: ABS Water Account 2015-16 cat. 4610.0, ABS Australian Industry 2016-17 cat. 8155.0

Note: Intensities and productivities are based on Industry Value Added figures provided by ABS.

Appendix B. Agriculture Industry Assistance (1900s-1980s)

The following describes agricultural industry assistance specific to various food-related industries to complement the discussion on the developments of food from World War II to the end of the 1960s. Information was sourced from the Official Year Books of the Commonwealth of Australia published by the Australian Bureau of the Statistics from 1920 to 1990.

Wheat

Wheat was one of the most important crops in Australia. During the beginning of World War I, the wheat industry was experiencing low prices, marketing and transport issues and a large accumulation of surplus stock in many of the exporting countries. In response to these issues, the Commonwealth government intervened and in 1938 enacted the Wheat Industry Assistance Act 1938 (with supplementing assistance legislation passed in the states) to stabilise the price of wheat used for flour for home consumption.

In 1939, in the following year, under National Security Regulations, the government implemented the Wheat Acquisition Regulations and established the Australian Wheat Board under which it was given powers to purchase, sell and dispose of wheat, to be responsible for all matters concerning handling, storage, protection and shipment of wheat. The Wheat Acquisition Regulations provided for the Minister for Commerce and Agriculture to determine the compensation paid for wheat acquired by the Commonwealth.

In 1946, the Commonwealth Government passed the Wheat Industry Stabilisation Act, establishing a stabilisation fund comprised of tax contributions under the Wheat Export Charge Act and the Wheat Tax of the same year. In 1948, the Act was amended to provide for the responsibility of internal and external marketing of wheat under one central authority. These Acts were implemented through a number of State Wheat Industry Stabilization Acts. The Australian Wheat Board (replacing the Wheat Industry Stabilization Board) was responsible for administering Wheat Industry Stabilization Plans under the Industry Stabilization Acts from 1948. These were in operation for several decades. The main feature of wheat stabilisation plans included the provision of home-consumption prices, the pooling of local and overseas revenue to ensure guaranteed prices based on the cost of production indexes, supported by taxes collected by the stabilisation fund, paid to farmers to meet guaranteed prices and paid by farmers when prices were higher than guaranteed prices.

In 1968 and 1969, storage and marketing became a problem for the industry. By the late 1960s, favourable prices had led to increased wheat production for both wheat exporters and importers

In 1969, to respond to emerging issues, the Australian Wheat Growers Federation formed a plan control production levels to which wheat delivery quotas were imposed (ABS 1969). Other bulk handling systems controlled by Grain Elevator Boards in the states also contributed to the management of wheat.

Oats, Barley, Sorghum, Maize, Rice

Oats were sold on 'fair average quality' basis through voluntary pools in Victoria, South Australia and Western Australia. For barley, the bulk of crop was acquired and marketing by grower controlled boards. Pooled returns from sales were distributed to growers at standard rates for the individual grades and varieties delivered. The Victorian and South Australian crops were marketed by the Australian Barley Board (a joint board established by the two state governments), and the Queensland and Western Australian Barley Boards handled the crops of their respective States. Rice production was protected by tariffs, and rice cultivation areas were controlled.

Sugar

The production and sale of sugar were controlled by sugar agreements, particularly between the Commonwealth and Queensland Governments (Queensland as the dominant sugar producer) to control price of sugar in Australia. Similar to wheat, governments also acquired and pooled sugar produced. In 1967, under the Sugar Marketing Assistance Agreement Act 1967 and the Sugar Industry Assistance Act in 1967, the Commonwealth government provided financial assistance to the sugar industry. International agreements on the trade of sugar were in operation since the late 1930s to control exports through quotas. Other agreements were between Australia and the UK and the US. Bulk-handling systems were also in place.

Vegetables, Fruit and Vineyards

Special potato boards were established to control potato marketing under the war-time legislation. In 1942, the Australian Potato Committee was formed under the National Security (Potatoes) Regulations. The marketing of potatoes was also subject to guaranteed pricing policies. Special boards also existed for apple and pear industries under the Apple and Pear Organization Act 1938-1966, responsible for the organisation and control of exports of apples and pears, for canned fruit industries, responsible for the overseas marketing and for the wine industry, responsible for domestic and international marketing. Apples and pears were also acquired and marketed under the National Security (Apple and Pear) Regulations.

Meat, Dairy and Poultry

The Australian Meat Board, first established in 1936 and then reconstituted in in the 1960s, was responsible for the marketing of meat of beef, mutton and lamb. It implemented research schemes and guarantees as well as bilateral agreements, purchase arrangements and trade controls.

Trade of dairy products was also highly regulated by the Commonwealth Government. Stabilisation schemes were implemented to the butter and cheese industries, also subject to guaranteed prices. Dairy industries received bounties as well as financial assistance towards research and promotion. An Australian Dairy Product Board, first established in the mid-1920s, and reconstituted in the late 1940s, also controlled the purchase and sale of dairy products.

In 1965, a Commonwealth industry stabilisation scheme for the egg industry was in operation. Egg boards existed to control the marketing of eggs in a number of states (New South Wales, Victoria, Queensland and South Australia. The industry was also subject to trade controls. The poultry industry during the mid-1960s further benefited from assistance schemes from the Commonwealth government.

Table B1 provides a summary of agricultural assistance and relevant legislation from 1900s to 1980s.

Table B1. Agricultural assistance and arrangements from the 1900s to 1980s

Industry	1900s to late 1930s	1940s to 1960s	1970s to 1980s
General	• Bounties Act 1907 • Fertiliser Acts (NSW, 1904; VIC, 1915, QLD, 1914; SA, 1918; WA, 1905; TAS, 1912)		• Rural Reconstruction Scheme 1971 • Rural Adjustment Scheme 1976 • Agricultural Research • Research Schemes • Extension Services
Crops and Crop Products			
Wheat (other crops including oats, barley, sorghum, maize, rice)	• Wheat Industry Act 1938 • Australian Barley Board	• Australian Wheat Board 1939 (under National Security (Wheat Acquisition Regulations) • Wheat Industry Stabilisation Act 1948 • Wheat Stabilisation Plans (1947-48 to 1951-52, 1953-54 to 1957-58, 1958-59 to 1962-63, 1963-64 to 1967-68, 1968-69 to 1972-73) • Wheat delivery quotas plan 1969 • Wheat Growers Federation 1969 • Bulk-Handling Systems • International Wheat Agreements (from 1949) • International Grains Arrangement	• International Wheat Agreements 1971 • Wheat Marketing Acts 1979, 1989 • Wheat marketing and pricing arrangements (1984-85 to 1988-89) • Wheat Industry Stabilisation Plan (1974-75 to 1979-80) • Wheat Delivery Quotas Plan • Wheat Standards • Bulk handling and storage of wheat • Barley marketing – responsibility of special boards in NSW and Queensland, the Australian Barley Board in Victoria and SA and the Grain Pool of Western Australia in WA • Sorghum marketing – responsibility of special boards in QLD, including the Central QLD Grain Sorghum Marketing Board, QLD Grain Growers Association and in NSW • Oats marketing – responsibility of special boards in NSW, of the Oat Growers Pool and Marketing company in VIC, the Australian Barley Board in SA and the Grain Pool of Western Australia in WA

			• Maize marketing – responsibility of special boards in QLD and NSW • Rice marketing – responsibility of special boards in QLD and NSW
Sugar Cane	• Sugar Agreement 1923 (Cmth and QLD governments) • International Sugar Agreement 1937	• British Commonwealth Sugar Agreement 1953 • Financial Assistance to sugar industry (Sugar Marketing Assistance Agreement Act 1967, Sugar Industry Assistance Act 1967) • International Sugar Agreement (1953, 1958, 1968) • Fruit Industry Sugar Concession Commission and Sugar Rebates • Bulk Handling	• Sugar Agreement 1975 • International Sugar Agreement 1973 • Commonwealth Sugar Agreement (terminated in 1974) • Fruit Industry Sugar Concession Committee • International Sugar Agreement 1978
Vegetables (processed vegetables, potatoes)		• Potato marketing boards • Australian Potato Committee 1942 (under National Security (Potatoes) Regulations) • Guaranteed minimum prices	• Potato marketing boards (SA, WA)
Fruit	• Apple and Pear Organization Act 1938-1966 • Apple and Pear Export Charges Act 1938-1968 • Canned Fruits Export Charges Act 1926-1966	• Australian Apple and Pear Corporation Board • Canned Fruits Export Marketing Act 1963 • Canned Fruits Excise Act 1963 • Australian Canned Fruit Sales Promotion Committee 1959	• Australian Apple and Pear Corporation Act 1973, replaced the Australian Apple and Pear Board in 1974 – export control and regulation • Stabilisation plan for apples and pears 1971 • Fruit growing Reconstruction scheme 1972
Vineyards (wine, dried vine fruit industries)	• Dried Fruits Export Control Act 1924 • Wine Overseas Marketing Act 1929 • Australian Wine Board		• Australian Dried Fruit Corporation 1979 replaced the Australian Dried Fruit Control Board • Dried Vine Fruit Stabilisation Scheme 1978-80 • Dried Vine Fruits Stabilization Act 1971
Pastoral Production			
Meat	• Patterson Plan 1926-1934 • Dairy Produce Export Control Act 1924-66	• Dairy Produce Levy Act 1958 • Butterfat Levy Act 1965-1966	• Meat Export Charge Act 1973

	• Australian Meat Board 1935 • Meat Export Control Act 1935-53 • Meat Export Charges Act 1935 • United Kingdom long-term purchase arrangements 1939-1952	• Australian Meat Board (reconstituted 1964) • Meat Industry Act 1964-69 • Meat Research Schemes 1965 • Livestock Slaughter Levy Act 1964-1966 • Lamb Guarantee Scheme 1962-63 • US-Australia Meat Agreement 1964 • UK long-term purchase agreements 1953	• Australian Meat and Livestock Corporation 1977 to replace the Australian Meat Board • Beef Industry (Incentive Payments Act 1977
Other rural industries			
Dairy	• Dairy Produce Export Control Act 1924-1966 • Dairy Produce Control Board 1924-35	• Dairy Industry Assistance Acts 1942 • Dairy Industry Stabilisation Fund 1948 • Home Consumption Price 1948 • Dairy Industry Extension Grant 1948 • Australian Dairy Produce Board (reconstituted in 1947) • Equalisation schemes • Commonwealth bounties • Bounty Act 1962 • Commonwealth Stabilisation Plans • Dairy Industry Extension Grants • Processed Milk Products • Australian Dairy Industry Council 1958 • Dairy Produce Levy Act • Butter Fat Levy Act 1965	• Kerin Plan 1986 • Dairy Industry Stabilization Act 1977 • 1977 Australian Dairy Industry Conference replaced the ADIC • Marginal Dairy Farms Reconstruction Scheme 1970 • Sixth five-year stabilisation plan 1972 • Australian Dairy Adjustment Program (MDFR broadened) • Dairy Produce Act 1975 • Equalisation Schemes
Pig and Poultry		• Pig Research • Stabilisation Scheme (egg industry) 1965 – Poultry Industry Levy Act 1965, Poultry Industry Levy Collection Act 1965, Poultry Industry Assistance Act 1965 • Poultry Industry Assistance Act 1965-1966 • Chicken Meat Research	

	• Egg Export Control Act 1947-1966 • National Security (Egg Industry) Regulations	
Bee Farming	• Honey Levy Acts 1962	• Australian Honey Board • Honey Levy • Honey Export Charge Act 1973
Fisheries	• Fisheries Act 1952 • Continental Shelf (Living Natural Resources) Act 1968 • Whaling Act 1960	

Source: Australian Bureau of Statistics 1969, Year Book New South Wales No. 60 1969, cat. no. 1300.1, ABS, New South Wales.

Appendix C. Government involvement in EWF

The following provides the details of each jurisdiction to support the discussion in Chapter 6.

Commonwealth and states

Government involvement in EWF has varied across the jurisdictions and the governments' responsibilities and scope to influence EWF sectors has varied across sectors. Together, these reinforce separation of EWF.

Commonwealth

The Commonwealth governments' involvement in EWF sectors varied across sectors, largely involved in agricultural and mining sectors than in water, for which its involvement was limited and in electricity for which Commonwealth had little role in the electricity sector, limited only to the extent of its involvement in the Snowy Hydro Scheme. As mentioned, the role in mining and agriculture was associated with the Commonwealth's power in trade and external affairs for which it assumed the role in assisting sectors (through financial assistance and direct intervention through marketing arrangements) sectors.

Energy

In the early periods, the role of the Commonwealth government in areas of electricity was very limited as most of the power over electricity matters were at the state level. As mentioned, Commonwealth government involvement in electricity was seen in the development of the Snowy Hydro-Electric Scheme in 1949.

While the state remained constitutionally responsible for energy in their jurisdictions, the Commonwealth government's involvement in the energy sector was seen in a number of areas. This included national energy policy making seen in a number of national policy documents particularly since the late 1970s to the present, the operation of the Snowy Mountains Hydro Scheme, the coordination of energy reforms through the National Competition Policy and in particular the development of the National Electricity Market.

Since the 1970s, national energy policy has been a priority and the Commonwealth has played an important role in setting the overall direction for the sector in terms energy sector reforms, energy market development and in particular, energy-related environmental policy such as renewable energy policy and emissions reductions (part of the Commonwealth's international commitments). The Commonwealth has been responsible for the Renewable Energy Target, various energy white papers and the introduction of the National Energy Security Assessments.

With the development of the National Electricity Market and the National Energy Customer Framework, energy matters have been dealt with at the national and inter-governmental level supported by national energy legislation and regulation and the establishment of a number of inter-state, federal agencies and inter-governmental councils.

Inter-governmental energy councils have included the Australian Minerals and Energy Council, the Australian and New Zealand Minerals and Energy Council, the Ministerial Council on Energy, Ministerial Council on Mineral and Petroleum Resources, the Standing Council on Energy Resources and more recently the COAG Energy Council. Other national based organisations have included the Australian Renewable Energy Agency, the Clean Energy Regulator amongst other Climate Change focussed organisations. One of the most recent organisations to have been formed is the Energy Security Board, formed in 2017 to implement the latest energy reforms as recommended by the Independent Review into the Future Security of the National Electricity Market by Dr Alan Finkel. The Commonwealth continues to play an important role in national energy policy through the work carried out by the COAG Energy Council and cooperation with the state governments.

Mining

The Commonwealth government has been responsible for external matters relating to mining matters related to mining exports as specified by the Constitution. General assistance to mining from the government was provided under a number of legislation. Commonwealth government had an important role in the regulation and the encouragement of mineral exploration. Its role in mining was through international trade, customs and excise, taxation and loan raisings, pricing of crude oil, technical and scientific assistance, and financial assistance to encourage projects. Financial assistance (through subsidies) by Commonwealth was provided to encourage projects of national and economic importance, including the Petroleum Search Subsidy Scheme from 1957 to 1974. The Commonwealth government assisted the mining industry through the activities of government agencies including a number of nation-level and inter-state based organisations reflecting greater involvement by the Commonwealth government. These included the Australian Mining Council in 1940 followed by the 1941 Minerals Committee and the Mining Industry Advisory Panel in 1944. In 1947, the Joint Coal Board was established between the Commonwealth and the NSW state government. In the late 1970s to the late 1980s, the Commonwealth government was particularly responsible for oil pricing until oil pricing was deregulated.

Water

In the early periods, the Commonwealth's role in water was limited to the coordination of the River Murray states in 1915, its involvement in the development of the Snowy Mountains Hydro

Scheme (given its duel electricity and irrigation purpose) in the 1940s and financial assistance to the state for water resource development in the 1960s, under the National Water Resources Development Programme followed by the Federal Water Resources Assistance Program in 1984.

The responsibilities of Commonwealth government has evolved across periods. However, aside from the Snowy Mountains Hydro Scheme, the Commonwealth was not directly involved in water matters. Centralisation of water and coordination was seen with the establishment of the Australian Water Resources Council in 1962. Given the transboundary nature of water, Commonwealth government has played an important role in facilitating the coordination and cooperation that has been increasingly required between state governments (seen in the management of the Murray-Darling Basin). Coordination was particularly a feature of the water reforms which saw the development of new inter-governmental and national agencies and through the NCP.

In the 1970s, water industry issues and environmental water issues emerged, giving rise to the need for reform and change in water sector management. Since 1975, national policies and inter-governmental and national agencies were established to facilitate the change required in water management. Recognition of water as national significance further encouraged a stronger role for the Commonwealth government and has required inter-governmental cooperation to deal with water issues. Commonwealth involvement was evident in the implementation of the first water reforms in 1994 (which became part of the overall NCP), followed by the National Water Initiative in 2004. Management of the River Murray remained an important area of Commonwealth involvement to coordinate the River Murray state (NSW, Victoria and SA) under the River Murray Agreement which transitioned to the management and governance of the Murray-Darling Basin in which the Commonwealth continued to play an important role.

New organisations were developed during the period to support changes in water sector development. The Australian and New Zealand Environment and Conservation Council (ANZECC) played a key role in integrating environmental concerns in water sector policy. In 1994, the Australian Water Resources Council, previously the peak forum for water sector development combined with the Agriculture Council of Australia and New Zealand and the Australian Soil Conservation Council to form the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ). The National Health and Medical Research Council (NHMRC) also had played a role in areas of public health, particularly in the context of water quality. Such national level organisations had played a key role in informing and developing water policy. New organisations for managing the Murray-Darling Basin were also created (MDB Council, MDB Authority).

The enactment and amendment of the Water Act 2007, was an important milestone for the Commonwealth in relation to water, as one of the first pieces of national water legislation, allocating a number of water responsibilities to national level organisations such as Murray Darling Basin Authority, the Bureau of Meteorology and the Australian Competition and Consumer Commission. In 2008, powers of the state over the Murray-Daring Basin was referred to the Commonwealth, enabling the Commonwealth greater role in the managing and governance of water.

Food

Particularly during the war, the Commonwealth government played a prominent role in agriculture in the control of production, marketing and stabilisation for the protection of farmers' incomes, as mentioned above.

As the Commonwealth governments' direct involvement reduced in the area of agriculture during the 1970s, its role, however, remained in areas of food policy such as safety and nutrition. During the period, the Commonwealth government, however, played a greater role in the area of food regulations and food standards, developing regulations in cooperation with the states and New Zealand. There was increased centralisation in the area of food regulation during the period.

After years of reform in the sector, the Commonwealth had a prominent role agriculture and food policy. Several national policies were released in the last few decades including the National Food Industry Strategy, the National Food Plan, the Agricultural Competitiveness White Paper and the National Food Waste Strategy. Commonwealth's role has been in promoting and developing the country's agricultural export potential.

In EWF sectors, although reforms have led to the reduce direct role, particularly in energy and agriculture, a common theme to all sectors has been the increasing prominence of the Commonwealth in national policymaking, where EWF have been and continue to be treated as important national matters.

An important theme in relation to government involvement during the period was the prominence of the Commonwealth government, particularly in national policy and in coordinating state developments under a national agenda. The Commonwealth's role in policy was evident in the National Competition Policy of 1995, a means for which the Commonwealth government could coordinate economic reforms across the country that were implemented at the state level. During this period, the Commonwealth government played an important role in addressing issues of national concern including the country's economic performance and environmental issues.

States

Government involvement in the states varied across EWF sectors. For example, while Victoria's electricity sector was centralised 1918, SA's electricity sector remained private until the 1940s, and while multiple agencies were responsibilities for water (supply and irrigation) in some states, a single department was made solely responsible (for example in SA, Tasmania). Mining and agriculture were largely similar across all state. Differences were mostly in the electricity and water sectors.

New South Wales

Mining, Agriculture and Food

Control over agricultural, pastoral and mining activities was centralised at a state level with the state responsible for regulation, for example, through land legislation in both sectors (with implications on water use), financial assistance and in the establishment of experimental farms.

In mining, the government was responsible for providing scientific, technical (equipment hire) and financial assistance (grants for mineral discovery and loans), general supervision of mining industry and administration of mining legislation, shared by the Mines Department and the also the Joint Coal Board (established in 1947). The state government also owned and operated coal mines and collieries.

In the later periods, state government involvement in the agricultural sector was associated with rural banks, rural finance and assistance, and the administration of the Farmers Relief Act 1932. In 1935, the Rural Bank through its irrigation agency was responsible for the administration of financial assistance to settlers in irrigation areas. Statutory marketing boards were established to manage the marketing of numerous rural products (Oats Marketing Board, Rice Marketing Board) (IC 1991c).

From the 1970s, the state government played an important role in the agriculture sector through the provision of financial support for rural adjustment to support producers in transition while sector underwent liberalisation. In 1971, the Rural Assistance Board was established under the provisions of the Rural Assistance Act 1971 and was responsible for administering the Commonwealths' rural adjustment programs, implementing the Rural Reconstruction Scheme until 1976 and then later the Rural Adjustment Scheme. These Schemes comprised of different types of loan assistance for continuing producers and for exiting producers including household support, and drought assistance. As the government role in the direct marketing of rural products declined, the main role of government was in policy and regulation.

In the late 1990s, government agencies, such as Safe Food NSW and then followed by the NSW Food Authority (2004), were established and made responsible for food safety regulation and the

implementation of food safety practices, along with local councils and the government's health department.

Electricity and gas

Electricity was introduced in NSW, in the latter half of the 1800s, supplied by both municipalities and private firms. Electricity in NSW in its early developments was decentralised.

Between 1901 and 1938, a number of organisations across NSW were responsible for the generation of electric power. Major organisations include the Sydney County Council, the Department of Railways, the Electric Light and Power Supply Corporation and the Clarence River County Council. In 1902, the Electricity Supply Undertaking under the Municipal Council of Sydney was established. Under the Local Government Act 1906, councils had powers over the manufacture and supply of gas, electricity and hydraulic power (ABS 1908).

The first steps towards centralisation of electricity in the state were seen with the enactment of the Gas and Electricity Act in 1935, one of the first laws to enable coordination of electricity supplies in NSW. Under the Act, the Electricity Advisory Committee was assembled to investigate proposals involving the construction of power stations, increasing in generator capacity and the installation of main transmission lines. In 1945 and 1950 further centralisation occurred with the establishment of two electricity organisations, firstly the Electricity Authority of New South Wales, formed under the Electricity Development Act 1945 and secondly, the State Electricity Commission of New South Wales, formed under the Electricity Commission Act 1950. The Electricity Authority was responsible for promoting and regulating the coordination, development, expansion, extension and improvement of electricity supply and was an advisory body responsible to the Minister of Local Government, and then the Minister for Mines and Energy in the 1970s (ABS 1976, p. 979). The authority also provided technical advice to retail electricity supply authorities concerning retail tariffs, public lighting and standardisation of materials and equipment. It also administered the rural electricity subsidy scheme and the Traffic Route Lighting Subsidy Scheme (ABS 1970a, p. 955).

The State Electricity Commission was also responsible to the Minister for Local Government. It was empowered to acquire electricity undertakings and made responsible for the generation and transmission to bulk consumers and distributors such as local government bodies (e.g. Sydney Country Council) to supply the state.

The supply of gas in NSW in the early periods was mainly privately run. Three private companies that supplied gas for public and private lighting within the metropolitan area of Sydney included the Australian Gas Light Company, the North Shore Gas Company, and the Manly Gas, Light, and Coal Company.

Over the years, the state government played a role the provision of financial assistance including the Rural Electricity Subsidy Scheme in the 1940s, the State Energy Research and Development Fund (established in 1986 to support development, demonstration and commercialisation of new energy technologies), the Electricity Development Fund (established in 1987 to support Country councils to maintain supply systems) and other assistance schemes.

Until the early 1990s, the Electricity Commission of NSW continued to be the main body responsible for electricity generation and transmission. In line with economic reform, the Commission underwent corporatisation followed by restructuring. In 1992, the Commission was replaced by the state-owned monopoly, Pacific Power, to be responsible for the generation, and by the statutory authority, Electricity Transmission Authority trading as TransGrid, to be responsible for electricity transmission (Rann 1998). Three pieces of legislation were enacted; Electricity Supply Act 1995, Energy Services Corporations Act 1995 and the Sustainable Energy Development Act 1995. Under the legislation, Pacific Power was split into state-owned generation companies, Delta Electricity and Macquarie Generation. In addition, six energy services were established, the wholesale market was established, and competition was introduced. By 1996, distribution companies were corporatised and by 1998, the National Electricity Market was operational (Rann 1998).

In the later periods, government involvement in the electricity sector has been largely limited to policy and regulation, no longer responsible for the operation of the industry as it had been through the state commission. By 2015, state-owned generation businesses were privatised. In 2017, leading generators included AGL Energy (29%), Origin Energy (23%) and Snowy Hydro (19%) (AER 2017b, p. 44). In the same year, electricity networks were partially privatised, with a number of businesses acquiring long-term leases to the state's networks (AER 2017b).

While the industry is driven by the market forces, much of the government involvement has been directed at policy including renewable energies. Economic regulation has been the responsibility of the independent regulator, the Independent Pricing and Regulatory Tribunal Home (IPART).

Water

In NSW, water and sewerage were originally the responsibilities of the Sydney City Council from as early as 1842 under respective water committees and sewerage committees. The Water Committee was responsible for the supply of water to the city and Suburbs, setting of water rates and exemptions, licensing of plumbers, making and publishing of by-laws relating to water supply and fountains (NSW Government State Archives & Records 2017d). From 1850, the main water supply and sewerage systems of Sydney and surrounding suburbs were under the control of the City Corporation, who under the authority of the Legislative Council could construct water and sewerage systems. Several other suburban councils had also constructed local systems. In 1853,

metropolitan sewerage systems were initiated by the City Commissioners. In 1880, the Country Towns Water Supply and Sewerage Act was passed with the objective of municipalities to construct systems of water supply and sewerage. These works were to be financed by the state who also could construct water and sewerage where municipalities did not. In 1888, the state government established the Metropolitan Board of Water Supply and Sewerage to take over responsibility for the administration of both water supply and sewerage systems through the County of Cumberland (ABS 1908).

In the following period, two main organisations were responsible for water supply and sewerage systems: the Metropolitan Water, Sewerage and Drainage Board, which replaced the Metropolitan Board of Water Supply and Sewerage in 1925 covering Sydney and its suburbs, and the Hunter District Water Board covering Newcastle and its suburbs. The Public Works Department was also involved in carrying out the construction of water and sewerage works. In country districts, local governments managed waterworks and sewerage works constructed by the Public Works Department. In 1935, councils were given the responsibility for the construction of new waterworks with state assistance and with the councils able to raise loans to finance their costs. Before that, state governments had carried out construction work, afterwards transferring control to councils (ABS 1941, p. 652).

Responsibilities for water were shared between local governments, metropolitan boards, state commissions or state government departments. Statutory authorities in the form of metropolitan boards were responsible for water supply and sewerage with local government and state government involvement in the construction of waterworks. Metropolitan water supply and state irrigation were centralised while country town water supplies were under decentralised control. In country towns, local councils controlled the provision of water supply and sewerage and with construction both by local and state government. Irrigation was the responsibility of a state statutory authority, Water Conservation and Irrigation Commission established in 1916. Its responsibilities included: the construction and control of water conservation work and irrigation areas; establishment, operation and maintenance of works for domestic and stock water supply; irrigation districts, flood control districts; sub-soil or surface drainage district; use of artesian and sub-artesian waters, constitution of water trusts and in addition the provision of assistance under the farm water supply scheme. The Commission was also responsible for the issue of licences authorising the construction or private works for conservation, irrigation, water supply drainage and the prevention of inundation. The Public Works Department and the Water Conservation and Irrigation Commission were jointly responsible for the improvement of rivers and foreshores in NSW.

Large state authorities including special boards responsible for both rural and urban water supply and sewerage systems remained responsible for water over the years. At the beginning of the 1970s, the Water Conservation and Irrigation Commission was responsible for water until it was replaced in 1976 by the Water Resources Commission. The Commission was responsible for the control, management and development of water resources in NSW, except in areas under the Metropolitan Water Sewerage and Drainage Board, the Hunter District Water Board, the Broken Hill Water Board or under a municipal shire council.

The government maintained control over the water sector through its statutory authorities before they were replaced by government departments. From the late 1980s, government departments for water were established replacing the existing water commissions. In 1987, the NSW Department of Water Resources was set up, replacing the Water Resources Commission, as the first government department of the state solely devoted to water resources matters. In 1995, the department was then replaced by the Department of Land and Water Conservation which was then succeeded by a number of departments for water. Currently, the Department of Primary Industries has water responsibilities under the Office of Water.

Water supply remains in the responsibility of government through its state-owned corporations. Such include WaterNSW (from 2014 replacing the Sydney Catchment Authority which was established in 1998) responsible for bulk supplies to the Greater Sydney region, Sydney Water (responsible for retail functions for residents within this area) and Hunter Water (undertaking both bulk and retail functions for residents of Newcastle and proximate towns and cities). Economic regulation of water pricing is the responsibility of an independent agency (Independent Pricing and Regulatory Tribunal) and not the responsibility of the government.

Victoria

Mining, Agriculture and Food

The state government through its relevant mining departments provided both financial and technical assistance to the mining sector, responsible for promoting exploration of minerals and the administration of a number of mining-related acts (petroleum, pipeline, mining and extractive industries), leases and licences to regulate mining activities. Government departments were responsible for mining services, the provision of technical assistance and information.

The state's role in agriculture was similar to other states with regards to assistance. In the agricultural sector, the government has been mostly responsible for policy and administering legislation, and through statutory authorities, responsible for statutory marketing arrangements until they were disbanded as a result of reforms. This resulted in a decline of government involvement in the direct marketing of rural products. The government, however, played an

important role in rural adjustment particularly in providing support for producers in transition. Government departments provided a number of services, research, extension and regulation. In 1977, the Rural Finance Commission (replacing the Rural Finance and Settlement Commission) was established to provide assistance for rural adjustment (ABS 1985d).

Statutory marketing authorities included the Australian Barley Board (also operating in South Australia) and the Egg Marketing Board along with others (IC 1991c).

Electricity and gas

Electricity in Victoria was introduced in the late 1880s and was supplied by private firms, the Melbourne City Council and other local councils. Under the Local Government Act of 1903, councils were responsible for the regulation and maintenance of lighting and were authorised to undertake the supply of light, heat, or motive power for public or private purposes (ABS 1909). Electricity generation and distribution at the beginning of the period were decentralised.

Centralisation in electricity development in the state was seen in the establishment of the State Electricity Commission of Victoria in 1919 (one of the many state corporations created during this time), vested with the control of the state' generation and distribution of electricity. Its main responsibilities included the operation of electricity undertakings, regulation of the state's electricity supply, and more importantly, coordination and unification of electricity supply in the state (ABS 1953). The gas industry, on the other hand, was privately run, under companies supplying gas for public and private lighting (ABS 1975). In 1950, the gas sector, however, experienced centralisation with the establishment of Gas and Fuel Corporation of Victoria.

In 1965, the Fuel and Power Act led to the centralisation of both the electricity and gas sectors. Under the Fuel and Power Act, the Minister for Fuel and Power was established and was made responsible for the operations of the State Electricity Commission of Victoria and the Gas and Fuel Corporation of Victoria. Under the Act, the Minister was responsible for the long-term development of fuel sources and supply (ABS 1975).

The State Electricity Commission of Victoria continued to be the main body responsible for electricity supply and also coal production up until its restructuring in 1993, following energy sector reforms. The long-standing organisation was replaced by new organisations, Generation Victoria (responsible for generation), National Electricity (responsible transmission) and Electricity Services Victoria (responsible for distribution). In 1994, National Electricity was further separated into Victorian Power Exchange (VPX) responsible for the secure operation of the main power system and PowerNet Victoria responsible for maintaining the high voltage grid (Rann 1998). In 1995, Generation Victoria was further divided into five generating businesses (Loy Yang A, Hazelwood, Yallourn W, Ecogen Energy, Southern Hydro). By 1995, the State

Electricity Commission was disaggregated with each entity corporatised (Roarty 1998). By 1998, all electricity sector entities were privatised, under the Kennet Liberal Government. Victoria was the first state to establish a large government body responsible for electricity, the first state Electricity Commission in the country and it was the first state to have achieved full privatisation in the electricity sector, in the late 1990s. Such changes effectively removed the direct government involvement of the previous arrangement under the state's commission.

Currently, Victoria's electricity sector remains privatised. Responsible for the majority of capacity include AGL Energy (31%), EnergyAustralia (25%) and Snowy Hydro (22%) (AER 2017b, p. 43) AusNet Services owns the state's transmission assets and is privately-owned.

Water

Water supply developments began at the local government level. By the early 1900s, water responsibilities were shared by two large statutory authorities. Firstly, the Melbourne and Metropolitan Board of Works, established in 1890, responsible for carrying out water supply, sewerage and drainage, for the supply of water to Melbourne and suburbs. Secondly, the State Rivers and Water Supply Commission, established under the Water Act of 1905, responsible for controlling the majority of all irrigation, rural domestic and stock supplies, town water supplies and flood protection and drainage, undertakings outside the metropolitan area. The centralisation of water occurred within the first decade after the formation of the federation (ABS 1949).

Over the years, the government maintained its control over the water sector through the large state authorities until the mid-1980s when control shifted to government departments. In 1975, the Ministry of Water Resources and Water Supply was established under the Water Resources Act 1975 and made responsible for water resources in the state. Part of the Ministry involved a Water Resources Council, consisting of eleven members appointed by the Governor in Council including a number of water representatives and irrigation representatives (ABS 1985d, p. 304).

In 1984, as a result of inefficiencies in advising and policy implementation areas, the State Rivers and Water Supply Commission and the Ministry of Water Resources and Water Supply were abolished and replacing the two organisations was the Rural Water Commission and the newly created Department of Water Resources, the first government department devoted to water resources in the state (ABS 1985d). The Melbourne and Metropolitan Board of Works, however, continued to manage and provide water supply, sewerage and main drainage services to the Melbourne metropolitan area.

By 1990, the Department of Water Resources, the Melbourne Metropolitan Board of Works and the Rural Water Commission were the main agencies responsible for water resources in the state.

In 1994, the Department of Water Resources was replaced by the Department of Conservation and Environment then succeeded by government water departments.

Currently, water supply remains a responsibility of the government through its state-owned corporations. Such include, Melbourne Water (responsible for bulk water supply, bulk sewerage and drainage) and three retail water and sewerage service entities: South East Water, Yarra Valley Water, and City West Water. Other regional water utilities that operate outside the metropolitan area are responsible for water supplies (Crase, Pawsey & Cooper 2015, p. 24).

Queensland

Mining, Agriculture and Food

Control over agricultural, pastoral and mining activities was centralised at the state level with the state government responsible for regulation and assistance, and the establishment of experimental farms. State assistance in mining was provided through relevant mines department, including the technical and financial assistance to prospectors, grants for construction and maintenance of roads, the hiring of equipment and other mining-related services (ABS 1970a). The Queensland Coal Board under the Coal Industry (Control) Act 1948-1978 was responsible for the administration and regulation of the coal mining industry. Technical assistance was also provided by a number of government bodies. Government agricultural departments were also responsible for agriculture-related matters. Statutory marketing authorities in Queensland included, in particular, the Sugar Board and the Rice Marketing Board (IC 1991c).

Electricity

Electricity was a decentralised and local government responsibility. Early in the period, public lighting from gas and electricity was provided by private companies. Government involvement began in the 1920s after the war, when the Brisbane City Council established an electricity supply service. In 1923, the Metropolitan Electricity Board was formed through the amalgamation of all municipalities receiving bulk supplies and later, functions were transferred to the Brisbane City Council Electricity Department. The City Council, also, operated electric tramway systems to supply electricity to the city of Brisbane and its surrounding suburbs (ABS 1953).

The centralisation of electricity commenced in 1938 with the establishment of the State Electricity Commission which was a response to a Royal Commission that recommended public ownership of electricity. The Commission was the first organisation in the state to undertake the functions of coordination, unification and control of the production and transmission of electric power at the state level. The Commission was a controlling authority rather than an operating authority. Its main powers were to; secure a proper and efficient supply of electric power, review tariffs, grant

licences to supply electricity, secure the safety of the public and control and advise electrical undertakings generally (ABS 1953).

In 1945, further centralisation took place under the Regional Electric Authorities Act, which provided for the creation of regions of electricity supply and constitution of Regional Electricity Boards, to facilitate the control and development of electricity supply in areas of low population density particular those in primary produce rural sectors. The Act provided for the transfer to these Boards of local electricity undertakings and the acquisition by the Boards of privately owned undertakings. This resulted in the establishment of three major networks in the southern, central and northern regions of the state.

The State Electricity Commission of Queensland was the main electricity body in Queensland, responsible for the development, coordination of electricity supply, regulation, administration of electricity legislation and the Queensland Electricity Generating Board, formed in 1976 (QLD Government Archives 2017) was responsible for generation and transmission. In 1985, both bodies were amalgamated to form the Queensland Electricity Commission, responsible for electricity supply and directed by a government-appointed board. The Commission was responsible for regulation, coordination of supply, construction and management of generation and transmission of electricity in the state (ABS 1985b).

In 1995, in line with electricity industry reform, the Commission was divided into two government-owned corporations: Queensland Generation Corporation trading as AUSTA Electric (responsible for generation) and Queensland Transmission and Supply Corporation (QTSC) (responsible for transmission, distribution and retail) (Rann 1998, p. 12). In 1997, further restructuring occurred. AUSTA Electric was separated into three independent and competing generating corporations; CS Energy, Tarong Energy and Stanwell Corporation as well as an engineering services organisation AUSTA Energy. Powerlink Queensland was established responsible for transmission and alongside seven independent government-owned distributors. Retail activities were divided according to regions comprised of amalgamated services forming the Northern retailer, Central retailer and the Southern Retailer.

In 2017, generation, transmission and retail remained predominately government-owned. State-owned corporations Stanwell and CS Energy controlled 65% of generation capacity. The most significant private operators included InterGen (10% of capacity) and Origin Energy (9%) (AER 2017b, p. 44). In 2016, the government merged its state-owned electricity distributors, Energex and Ergon Energy, under a new parent company called Energy Queensland (AER 2017b, p. 100).

Water

In the early developments of the water sector, water supply of the city of Brisbane and suburbs was administered by a board which in the 1860s, became the Board of Water Supply (Brisbane Board of Waterworks). In the 1909, water supply, sewerage and drainage were under the control of the Metropolitan Water and Sewerage Board, established under the Metropolitan Water and Sewerage Act 1909. By the 1930s, water supply and sewerage became the responsibility of the Brisbane City Council, under the Water Supply and Sewerage Department and then the Department of Works, Water Supply and Sewerage. Irrigation was the responsibility of the Commissioner of Irrigation and Water Supply who administered a number of water-related legislation including the Rights in Water and Water Conservation and Utilisation Act, the Irrigation Act 1922 and Water Acts 1926. Water responsibilities were shared between the state's commission (Commission of Irrigation and Water Supply) and the metropolitan council's statutory board (Metropolitan Works Board) responsible for water supply and sewerage systems in the metropolitan area (ABS 1948).

In 1978, the Queensland Water Resources Commission was established under the Water Resources Administration Act 1978, replacing the Commissioner of Irrigation and Water Supply. The Commission was the main planning and development authority for all waterworks in the state and responsible for the management, operation and maintenance of all water conservation works, assessment of water resources requirements, preparation programs for conversion, utilisation, protection and distribution of water and recommendations to the government. The government was responsible for providing assistance. Under the Farm Water Supplies Assistance Act 1958, technical assistance was provided to landholders for matters relating to water conservation and utilisation. Financial assistance was also provided through special agricultural bank loans.

During the 1990s water was the responsibility of the Department of Primary Industry followed by the Department of Natural Resources. A number of government departments succeeded. Currently the Department of Natural Resources, Mines and Energy is responsible for water policy.

More recently, the statutory authority, SEQ Water was responsible for bulk water supply and retail was the responsibility of three local government-owned retailer–distributors, Allconnex Water, Queensland Urban Utilities and Unity Water (PC 2011, p. 43). SunWater is a government-owned corporation responsible for water infrastructure development.

South Australia

Mining, Agriculture and Food

The government's role in mining (through relevant mines departments) was to provide financial assistance such as subsidies, technical assistance including various mining services, hire of drilling plant and mining equipment, drilling and testing and others. In administering a number

of mining acts and regulation, the government has had a regulatory role, also responsible for petroleum exploration, production, conservation and distribution of petroleum by pipeline. The government was also responsible for granting mining leases and licenses and collects royalties. State governments were similarly also responsible for financial and technical assistance in the agricultural sector as well as policy and regulation.

Electricity and Gas

In South Australia, early electricity developments were also decentralised under private companies, and local governments were responsible for generation, transmission and sale. Local Government Acts authorised governments to execute works for lighting. Under the Local Government Act 1934, local authorities were authorised to generate and supply electricity.

Electricity was centralised from the 1940s with the establishment of the South Australian Electricity Commission, followed by the Electricity Trust of South Australia (ETSA) in 1946, made responsible for the coordination and unification of the state's electricity supplies. In the gas sector, all production, however, was controlled by the South Australian Gas Company, a privately owned company, although regulated by state legislation (ABS 1953).

From the 1970s, the Electricity Trust of South Australia was the main body responsible for the majority of the state's electricity supply. It was responsible for unification, coordination and supply to consumers. By the mid-1990s, the Trust, in line with electricity industry reforms, was corporatised forming the ETSA Corporation – the largest transmitter, distributor and retailer of electricity trading in the state. The corporation was government-owned and comprised four major subsidiaries (ETSA Power, ETSA Transmission, ETSA Generation and ETSA Energy). In 1997, ETSA Generation was separated to form the South Australian Generation Corporation, known as Optima Energy. By 2017, electricity supply in the state was privatised. AGL Energy is the dominant generator controlling 45% of capacity (AER 2017b, p. 44). All transmissions networks were privately owned.

Recent energy security issues have however been of major concern since the state-wide blackouts in recent years. This has also sparked government attention to the state of the electricity sector bringing into question the need for government intervention to ensure energy security.

Water

Water was centralised since the sector's early developments. The water sector was the responsibility of government departments rather than statutory authorities. The Engineering and Water Supply Department under the Public Works Department (responsible to the Minister for works) constructed and maintained water supply and sewerage systems in the state. The controlling authority for irrigation (from 1930) was the Department of Lands with the Engineering

and Water Supply Department, the constructing authority for the Minister of Irrigation. Other government departments included the Department of Mines and the Department of Agriculture which both provided services and assistance in relation to water. The Department of Mines provided assistance to individual farmers in the provision of supplies from underground sources, and the Department of Agriculture provided an advisory service on water conservation and irrigation. Unlike other states, water matters in SA were the responsibility of state government departments (ABS 1976).

Over the years, the Engineering and Water Supply Department continued to administer all major water resources and public water schemes in SA, as the main body responsible for water. In 1992, water became the responsibility of the Department of Environment and Natural Resources, succeeded by various government water departments.

In 1995, the South Australian Water Corporation was established (under the South Australian Water Corporation Act 1994) with the power to supply water in the state, construct, maintain and operate infrastructure necessary for water provision. Most recently, SA Water, a state-entity has provided water and sewerage services (Crase, Pawsey & Cooper 2015, p. 31).

In 2002, the Essential Services Commission of South Australia (ESCOSA), an independent regulator was established and was responsible for water pricing.

Tasmania

Mining, Agriculture and Food

The state government role in mining was the provision of technical and financial assistance to the mining industry, mining leases, and geological and engineering advice. The Department of Mines was responsible for economic, hydrological and engineering geological work and the regional investigation and exploration of state's mineral resources. The state government's role in agriculture was also associated with financial assistance (ABS 1970a). Both mining and agriculture were responsibilities of government departments. Government departments were responsible for a number of rural adjustment and assistance schemes and policy-making.

Electricity

Electricity developed with the introduction of hydroelectric power commencing in 1892 with the construction of a small station by the Launceston City Council. Electricity developments were tied to hydroelectric power which was made possible by the state's water resources. Hydroelectricity was previously generated by private companies until the government took over development in 1914 when it set up the Hydro-Electric Department of Tasmania. Electricity development hence became centralised. In 1929, the Hydro-Electric Commission was established, replacing the Hydro-Electric Department. Electricity was controlled and operated at the state level (ABS 1953). The Hydro-Electric Commission was responsible for the electricity supply of the state through its hydro-power development since its establishment. In 1998, the Commission, in line with electricity industry reform, was disaggregated into three government-owned entities: Hydro-Electric Corporation (HEC) (responsible for generation with focus on power generation, asset and water management and consultancy services), Transend Networks Pty Ltd (responsible for transmission) and Aurora Energy Pty Ltd (responsible for distribution and retail of electricity) (ABS 1999). Although corporatised, the organisations remained government-owned.

Currently, both generation and transmission are predominantly government-owned. State-owned Hydro Tasmania owns nearly all generation capacity (AER 2017b, p. 44). Office of the Tasmanian Economic Regulator (an independent government agency) regulates the price.

Water

The original water supply in Tasmania was developed by the Imperial government in 1831. Prior to the formation of the federation, water supply was controlled by municipalities. Water developments were tied to hydropower development, largely under the responsibility of the Hydro-Electric Commission who was also vested, in addition to its power to develop and reticulate electric power, with the rights to the use of water in the state.

Local governments were responsible for own water supply, sewerage and irrigations schemes. Given the state's water resources, the state had little struggle with water compared with other state and water supply was mostly decentralised. Further, centralisation of water was seen in the late 1950s. Firstly, with the establishment of the Rivers and Water Supply Commission in 1958, responsible for controlling all natural waters, and in 1961, with the establishment of the Metropolitan Water Board, responsible for the overall control of water supply (responsible for water supply to cities, Hobart, Glenorchy, Kingborough and Clarence). Areas not serviced by either organisation were the responsibility of local municipal councils.

The River and Water Supply Commission (under the Water Act 1957) was empowered to take water from streams and lakes and issue water licences. By the 1980s, other statutory authorities

were formed including the North West Regional Water Authority to serve cities in the North West region. In 1984, the Hobart Regional Water Board replaced the Metropolitan Water Board (ABS 1985c). In 1989, the Department of Resources and Energy was made responsible for water following an amalgamation of responsibilities of the River and Water Supply Commission and the Hydro-Electric Commission. Water also passed to the responsibility of government departments.

According to the Productivity Commission (2011, p. 46), Tasmania has moved away from local government-owned bulk suppliers and local councils providing water, to three local government-owned vertically-integrated water utilities to provide water. These include Southern Water, Ben Lomond Water and Cradle Mountain Water.

Government departments responsible for water have included the Department of Primary Industries, Water and Environment, Department of Primary Industries and Water and currently the Department of Primary Industries, Parks, Water and Environment. The Department of Mines has also been responsible for the development and use of the state's groundwater resources.

Western Australia

Mining, Agriculture and Food

State government aid was provided under the Mining Development Act 1902, both financial and technical. A large amount of general developmental work was carried out by the government, particularly with regards to water supply. State governments provided assistance in the agricultural sector. Mining departments have mainly been responsible for policy and regulation.

Since the beginning of the century, agriculture has been the responsibility of the Department of Agriculture responsible for agricultural and food-related policy.

Electricity and gas

In the early years, the responsibility for the generation of electric power was assumed by a governmental authority, the Western Australian Government Electricity Supply, administered by the Commissioner for Railways and the distribution was mainly in the hands of the Perth City Council since 1912. Before that, electric power was reticulated to consumers by the Perth Gas Company.

Under the Government Electric Works Act 1914, the Western Australian Government Electricity Supply had the power to construct for the supply of electricity in the metropolitan area. For areas outside the metropolitan areas, the supply of electricity for domestic, industrial and traction purposes was generally the responsibility of local authorities. In 1902, the Kalgoorlie Electric Power and Lighting Corporation was established to supply power for the gold mines. Electricity

in WA was generated and distributed by a number of small and separate organisations both private and local government.

The centralisation of electricity in the state commenced with the establishment in 1945 of the State Electricity Commission of Western Australia, set up to coordinate the supply of electricity, generation and distribution throughout the state. The Commission was given the power to secure the coordination of all electrical undertakings in the state, to construct and operate power stations and transmission lines, and purchase and operate the undertakings of any supply authority. Local authorities were empowered to operate and construct power stations and other works associated with the supply of electricity, subject to the Commissions' authority. The Commission took over electrical undertakings in Perth and Fremantle formerly owned by Perth City Council, the Western Australian Government Electricity Supply, the Fremantle municipal Tramways and Electric Lighting Board and other metropolitan and municipal supply authorities (ABS 1960).

In 1975, the State Electricity Commission and Fuel and Power Commission were combined forming the State Energy Commission of Western Australia, responsible for the state's energy resources as the main supplier of gas and the main electricity generator in the state. Up until 1995, the Commission was the main body responsible for energy in the state. In 1995, the Commission was divided into separate electricity and gas corporations; Western Power and Alinta Gas to supply and distribute gas, both government-owned. The Office of Energy was formed as a regulatory agency.

More recently, generation and transmission have been controlled by state-owned corporations, Synergy and Horizon Power responsible for the generation and state-owned corporations Western Power Corporation and Horizon Power, responsible for transmission. Both public and private sectors participate in retail electricity. Other works such as in mining towns are private.

Water

In WA, government departments were responsible for metropolitan water supply, sewerage and drainage, water supply in the goldfields, agricultural and mining water supply and artesian waters (ABS 1940). Water supply was the responsibility of two state authorities, the Metropolitan Water Supply, Sewerage and Drainage Board (Metropolitan Water Supply, Sewerage and Drainage Board government department in 1964) and the Department of Public Works and Water Supply.

Control of water supply and sewerage was under two state authorities the Metropolitan Water Authority and the Public Works Department. At the beginning of the 1970s, the Metropolitan Water Supply, Sewerage and Drainage Board was the main authority responsible for metropolitan water supply until it was replaced by the Metropolitan Water Authority in 1982. The Public Works Department controlled the Goldfields and Agricultural Areas Water Supply and the Great

Southern Towns Water Supply along with water supplies to a number of towns and water for irrigation in the South-West Irrigation Districts.

In 1984, the Water Authority of Western Australia was formed (under the Water Authority Act 1984), as the main authority, responsible for the majority of water-related services in WA and for administering water-related legislation (ABS 1990). In 1996, the Water and Rivers Commission was established, and was responsible for water resources in the state until 2007 when its functions were transferred to a new water department, the Department of Water.

Water supply has also been government owned. The Water Corporation, a state-owned entity, has been the principal supplier of water in the state.

Northern Territory and Australian Capital Territory

In both territories, both electricity and water are managed together by state enterprises. Agriculture and mining are responsibilities of government departments.

The Electricity Supply Division of the Department of Construction was the main electricity supplier for the main population areas until 1978, when the NT Electricity Commission, a statutory authority, was made responsible for the generation and distribution of electricity, following the establishment of self-government. In 1987, the Power and Water Authority (a statutory authority) was created, responsible for the sale of natural gas, generation, distribution, transmission and sale of electricity, and water and sewerage services (ABS 1990). It was the main body responsible for electricity supply, water supply and sewerage services and natural gas development.

More recently, electricity has been provided by three main government-owned corporations, Territory Generation (generation), PowerWater Corporation (transmission) and Jacana Energy (retail and distribution). Electricity is regulated by the Utilities Commission, an independent regulator. PowerWater Corporation has been responsible for water supply across the NT.

In ACT, in 1988 the ACT Electricity and Water replaced the previous ACT Electricity Authority and was the main electricity distributor until 1995 when it was replaced by the ACTEW Corporation LTD. The corporation was established as the main body responsible for power and water supply. Electricity and water are now provided by a private joint venture ACTEW AGL. Regulation is by the Independent Competition and Regulation Commission.

Table C1 provides an overview of centralisation in electricity and gas and water sectors which overtime experienced substantial change, particularly across states. Changes in centralisation in mining and agriculture were associated with reform and liberalisation. The general pattern across states was that mining and agriculture sectors were the responsibilities of state government

departments. Agricultural statutory authorities controlled the marketing and sale of rural products until liberalisation of the sector in the 1970s.

Table. C1. Overview of centralisation in electricity and gas, and water sectors

State	Electricity and gas	Water
NSW	**1800s-1900s:** A number of organisations responsible for the generation including: Sydney County Council, the Department of Railways, the Electric Light and Power Supply Corporation and the Clarence River County Council **1935: UAP** Gas and Electricity Act 1935, one of the first laws to enable coordination of electricity supplies in NSW **1945: ALP** Electricity Authority of NSW formed to coordinate and regulate the electricity sector **1950: ALP** State Electricity Commission of NSW established to generate and distribute electricity **1992: LIB** Pacific Power (state-owned monopoly) replaces State Electricity Commission of NSW. Electricity Transmission Authority (TransGrid) to be responsible for electricity transmission **1995: LIB** Pacific Power split into state-owned generation companies, Delta Electricity and Macquarie Generation. **2015: LIB** State-owned business privatised **2017: LIB** Leading generators included AGL Energy, Origin Energy, and Snowy Hydro	**1840s:** Sydney City Council responsible for water and sewerage **1888: Free Trade** Metropolitan Board of Water Supply and Sewerage to take over responsibility for the administration of both water supply and sewerage **1916: Nationalist** Water Conservation and Irrigation Commission established responsible for water resources outside areas under control by Boards **1925: ALP** Metropolitan Water, Sewerage and Drainage Board replaces the Metropolitan Board of Water Supply and Sewerage and Hunter District Water Board established. Public Works Department to manage waterworks and sewerage in country districts **1976: LIB** Water Resources Commission to replace Water Conservation and Irrigation Commission **1987: ALP** NSW Department of Water Resources to replace the Water Resources Commission. State government departments to succeed **1992: LIB** Independent Pricing and Regulatory Tribunal of NSW established, to be responsible for water prices **1998: ALP** Sydney Catchment Authority responsible for bulk supplies **Present: LIB** WaterNSW, Sydney Water and Hunter Water (state-owned corporations responsible for water supply
VIC	**1880s:** Electricity supplied by private firms, Melbourne City Council and other local councils **1919: NAT** State Electricity Commission of Victoria established to control and coordinate electricity generation and distribution. Gas privately run **1950: COU** Gas and Fuel Corporation of Victoria established **1965: LIB** Fuel and Power Act 1965 to make Minister for Fuel and Power responsible for State Electricity Commission and Gas and Fuel Corporation **1993: LIB** State Electricity Commission to be replaced by Generation Victoria, National Electricity and Electricity Services Victoria. **1994: LIB** National Electricity to separate into Victorian Power Exchange and PowerNet Victoria **1998: LIB** All electricity sector entities privatised **2017: ALP** Leading generators included AGL Energy, Energy Australia, and Snowy Hydro	**1800s:** Local governments responsible for water supply **1890: LIB** Melbourne and Metropolitan Board of works established responsible for water supply, sewerage and drainage **1905: REF** State Rivers and Water Supply Commission responsible for all irrigation, rural domestic and stock supplies, town water, flood protection and drainage **1975: LIB** Minister of Water Resources and Water Supply responsible for water resources **1984: ALP** Rural Water Commission and Department of Water Resources to replace Ministry and State Commission. Melbourne and Metropolitan Board of Works continued to provide water supply, sewerage and drainage services **Present: ALP** Melbourne Water responsible for water supply, sewerage and drainage
QLD	**1880s**: Local governments responsible for electricity **1920: ALP** Brisbane City Council to establish electricity supply service **1923: ALP** Metropolitan Electricity Board formed from amalgamation of bulk supplies	**1860s:** Water supply administered by the Board of Water Supply **1909: MIN** Metropolitan Water and Sewerage Board established to control water supply and sewerage

	1938: ALP State Electricity Commission established to coordinate, control and unify electricity supply **1945: ALP** Regional Electricity Board established to control regional development **1976: COU** Queensland Electricity Generating Board formed to be responsible for generation and transmission **1985: NAT** State Electricity Commission and Queensland Electricity Generating Board amalgamated to form Queensland Electricity Commission, responsible for regulation, coordination and generation **1995: ALP** Queensland Electricity Commission divided into two government-owned corporation. QLD Generating Corporation (AUSTA Electric), QLD Transmission and Supply Corporation **1997: NAT** AUSTA electric separated into three generating corporations. Powerlink Queensland established responsible for transmission alongside other independent government owned distributors **2016: ALP** Government merged state-owned electricity distributors under Energy Queensland. **2017: ALP** Generation, transmission retail remained privately owned. Government-owned corporations control 65% generation capacity	**1922: ALP** Irrigation and Water Supply Commission responsible for irrigation Metropolitan Works Board responsible for water supply and sewerage systems **1930: COU/Pr** Brisbane City Council responsible for water supply and sewerage **1978: COU** Queensland Water Resources Commission established to replace the Commission, responsible for planning and development of waterworks **1990s: ALP** Water to become the responsibility of the Department of Primary Industry and succeeding government departments **Present: ALP** Statutory authority (SEQ) and three local government-owned retailers responsible for water supply
SA	**1880s:** Private companies and local governments responsible for generation **1934: LCL** Local authorities authorised to generate supply and electricity. Private companies responsible for providing electricity **1940s: LCL** South Australian Electricity Commission established in 1943 but replaced in 1946 by the Electricity Trust of South Australia responsible for coordination and supply **1990s: ALP** The Trust is corporatized forming the ETSA Corporation with four major subsidiaries (ETSA Power, ETSA Transmission, ETSA Generation and ETSA Energy). 1997 ETSA Generation separated to form SA Generation Corporation (Optima Energy) **2017: ALP** By 2017, electricity supply privatised. AGL Energy dominant generator controlling 45%.	**1800s:** Water centralised since early developments. Water is the responsibility of government departments included the Engineering and Water Supply Department under the Public Works Department **1992: ALP** Department of Environment and Natura Resources and succeeding government departments responsible for water **1995: LIB** South Australia Water Corporation established responsible for water **2002: ALP** Essential Services Commission of South Australia responsible for water pricing
TAS	**1892: MIN** Introduction of hydroelectric power with small station constructed by Launceston City Council. Hydroelectricity generated by private companies **1914: NAT** Hydro-Electric Department of Tasmania responsible for hydroelectricity developments **1929: NAT** Hydro-Electric Commission established to replace the Hydro-Electric Department **1998: ALP** The Commission is disaggregated into three corporatised government-owned entities: Hydro-Electric Corporation (HEC), Transend Networks Pty Ltd and Aurora Energy Pty Ltd. Present: Hydro Tasmania owns nearly all generation capacity. Office of the Tasmanian Economic Regulator regulates price	**1800s:** Original water supply developed by Imperial government. Water supply controlled by municipalities. **1900s:** Water developments tied to hydropower development largely under the responsibility of the Hydro-Electric Commission. Local governments responsible for own water supply. **1958: ALP** Rivers and Water Supply Commission established responsible for controlling water resources **1961: ALP** Metropolitan Water Board established responsible water supply alongside local municipal councils. **1984: LIB** Hobart Regional Water Board replaces the Metropolitan Water Board **1989: ALP** Department of Resources and Energy made responsible for water following an amalgamation of the River and Water Supply Commission and the Hydro-Electric Commission **2000s: ALP** Three local government-owned vertically integrated water utilities provide water

		2013: ALP TasWater formed – amalgamation of regional water corporations
WA	**1880s:** Responsibility for the generation of electric power assumed by governmental authority, Western Australian Government Electricity. Perth City Council responsible for distribution **1945: ALP** State Electricity Commission of Western Australia established to coordinate supply of electricity, generation and distribution **1975: LIB** State Electricity Commission and Fuel and Power Commission combine to form the State Energy Commission of Western Australia, responsible for state's energy resources as the main supplier of gas and electricity **1995: LIB** Commission divided into separate electricity and gas government-owned corporations, Western Power and Alinta Gas. Office of Energy to regulate energy sector **Present: ALP** Generation and transmission controlled by state-owned corporations Synergy, Horizon Power and Western Power Corporation. Retail both public and private	**1800s:** Government departments responsible for metropolitan water supply, sewerage and drainage, agricultural and mining water **1900s:** Water supply the responsibility of two state authorities the Metropolitan Water Supply, Sewerage and Drainage Board and Department of Public Works and Water Supply **1982: LIB** Metropolitan Water Authority replaces the Metropolitan Water Supply, Sewerage and Drainage Board. Public Works Department controls goldfield and Agricultural Areas. **1984: ALP** Water Authority of Western Australia formed as the main authority, responsible for water services and administering water legislation **1996: LIB** Water and Rivers Commission established responsible for water resources **2007: ALP** Department of Water established, taking over responsibilities of the Water and Rivers Commission **Present: ALP** Water Corporation principal supplier of water in the state
NT	**Pre-1970s:** Electricity Supply Division of the Department of the Construction main supplier of electricity (under Commonwealth). **1978: CL** NT Electricity Commission responsible for generation and distribution **1987: CL** Power and Water Authority established responsible for the sale of natural gas, generation, distribution, transmission and sale of electricity Present: Electricity provide by three main government corporations Territory Generation, PowerWater Corporataion, Jacana Energy. Enlectricity is regulation by the Utilities Commission	**1987: CL** Power and Water Authority established responsible for the sale of water and sewerage services **Present:** PowerWater Corporation responsible for water supply
ACT	**1988:** ACT Electricity and Water replaces previous ACT Electricity Authority **1995: LIB** ACTEW Corporation LTD replaces ACT Electricity Authority responsible for power and water supply **Present: ALP** Electricity and water are provided by a joint venture, ACTEW AGL.	**1988:** ACT Electricity and Water replaces previous ACT Electricity Authority **1995: LIB** ACTEW Corporation LTD replaces ACT Electricity Authority responsible for power and water supply **Present: ALP** Electricity and water provided by a joint venture, ACTEW AGL.

Appendix D. Data Sources

Table D1. provides a list of data sources used in the research in addition to sources referred to in the thesis. The analysis in Chapter 7: Portfolio, Ministerial Responsibilities and Organisations, Chapter 8: Policy, legislation and pricing and Chapter 9: Synthesis and recommendations is derived from the sources listed below. Data from each source has been compiled by the author to facilitate analysis. Sources are provided here for the ease exposition of the analysis.

Table D2 provides a list of the legislation cited in Chapter 8.

Table D1. Data Sources

Data	Detailed Data	Jurisdiction	Sources
Political parties and leaders (Prime Ministers and Premier)	Political parties in power and leader for each jurisdiction over time including periods in office (start date and end date)	**All jurisdictions**	Australian Politics and Elections Database, University of Western Australia http://elections.uwa.edu.au/
EWF-related portfolios and ministerial responsibilities	Cabinet ministries, list of ministers and portfolios held during period in office	**Commonwealth**	Department of Parliamentary Services (2017), *45th Parliamentary Handbook of the Commonwealth of Australia,* Parliamentary Library, Canberra https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Parliamentary_Handbook
		New South Wales	Parliament of New South Wales, NSW Parliamentary Record '*Part 6 : Ministries 1856 to the present*' pp. 1-8, 2017 https://www.parliament.nsw.gov.au/members/formermembers/Documents/Part%206%20combined.pdf NSW Administrative Arrangements Orders sourced from https://legislation.nsw.gov.au/#/view/regulation/1977/05/id4
		Victoria	Parliament of Victoria Hansard, 1856-2018, Ministry lists sourced from front pages of Government Hansards https://www.parliament.vic.gov.au/hansard/daily-hansard
		Queensland	Parliament of Queensland, Parliamentary Records: 52nd Parliament (2009), 53rd Parliament (2012), 54th Parliament (2015), 55th Parliament (2017) Queensland Parliament, Indexes to Parliamentary Debates from 1860 (to 2018) https://www.parliament.qld.gov.au/work-of-assembly/hansard/indexes-to-debates

			Queensland Government Cabinet and Ministerial Directory *(for recent and current ministers)*
		South Australia	Parliament of South Australia, Statistical Record of the Legislature 1836-2007 (2007) https://www.parliament.sa.gov.au/AboutParliament/From1836/Documents/StatisticalRecordoftheLegislature1836to20093.pdf Parliament of South Australia Digest (2007-2017) https://www.parliament.sa.gov.au/HouseofAssembly/BusinessoftheAssembly/RecordsandPapers/Digest/Pages/Digest.aspx Parliament of South Australia Ministers https://www.parliament.sa.gov.au/Members/Ministers/Pages/Ministers.aspx
		Tasmania	Parliament of Tasmania, Ministers of Legislative Council (1856-2017) http://www.parliament.tas.gov.au/history/tasparl/lcministers.htm Parliament of Tasmania, Ministers of Legislative Assembly (1856-2014) http://www.parliament.tas.gov.au/history/tasparl/haministers.htm Parliament of Tasmania, The Ministry (2018) http://www.parliament.tas.gov.au/HA/Cabinet.htm
		Western Australia	The Western Australian Parliamentary Handbook 24th Edition (Black, David, 2018) http://www.parliament.wa.gov.au/WebCMS/WebCMS.nsf/resources/file-parliamentary-handbook/$file/Parliament_Handbook_02072018.pdf
		Northern Territory	Parliament of Northern Territory, Ministries 1st-13th Legislative Assembly https://parliament.nt.gov.au/members/previous-assemblies
		Australian Capital Territory	Australian Capital Territory, Government Gazettes, Administrative Arrangements (1989-present) sourced from ACT Legislation Register https://www.legislation.act.gov.au/a/db_6271/ni.asp?dispmode=all,
EWF-related organisations	Government departments with EWF responsibilities Other government agencies with EWF responsibilities	**All jurisdictions**	Australian Bureau of Statistics, ABS Year Books Australia (1908-2012) cat. 1301.0 (available online) Government Department websites
		Commonwealth	Administrative Arrangement Orders 1906 to the present sourced from Commonwealth Government Gazettes: *(https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Browse_by_Topic/law/adminarrangements)Data currently available from* (http://www.naa.gov.au/information-management/information-governance/MoG-changes/index.aspx) Department of the Prime Minister and Cabinet website (https://www.pmc.gov.au/) *(for recent ministry lists)*
		New South Wales	Australian Bureau of Statistics, ABS Year Books NSW (1904-2004) cat. 1300.1 (available online) NSW Government State Archives and Records website, Agencies and Persons (https://www.records.nsw.gov.au/)
		Victoria	Public Record Office Victoria website, Agencies https://prov.vic.gov.au/ Australian Bureau of Statistics, ABS Year Books Victoria (1873-2002) cat. 1301.2 (available online)
		Queensland	Queensland State Archives website, Agencies https://www.qld.gov.au/recreation/arts/heritage/archives Australian Bureau of Statistics, ABS Year Books Queensland (1901-2001) cat. 1301.3 (available online)
		South Australia	State records of South Australia website, Agencies http://catalogue.archives.sa.gov.au

			Australian Bureau of Statistics, ABS Year Books South Australia (1913-1999) cat. 1301.4 (available online)
		Tasmania	Libraries Tasmania, Tasmanian Archives Online website, Agency Records https://librariestas.ent.sirsidynix.net.au/client/en_AU/tas/ Australian Bureau of Statistics, ABS Year Books Tasmania (1967-2000) cat. 1301.6 (available online)
		Western Australia	State Records Office of Western Australia website, Organisations and People, https://archive.sro.wa.gov.au/index.php/actor/browse Australian Bureau of Statistics, ABS Year Books Western Australia (1886-1998) cat. 1300.5 (available online)
		Northern Territory	National Territory Archive Service, Agencies https://navigator.nt.gov.au/ Northern Territory Legislation, Administrative Arrangements Order (2005-2017) https://legislation.nt.gov.au/en/Legislation/ADMINISTRATIVE-ARRANGEMENTS-ORDER
		Australian Capital Territory	Australian Capital Territory, Government Gazettes, Administrative Arrangements (1989-present) sourced from ACT Legislation Register https://www.legislation.act.gov.au/a/db_6271/ni.asp?dispmode=all,
EWF-related legislation	Legislation	**All jurisdictions**	Australian Bureau of Statistics, ABS Year Books Australia (1908-2012) cat. 1301.0, Canberra Australasian Legal Information Institute (AustLII), Historical and numbered Acts http://www.austlii.edu.au/ Federal Register of Legislation, State and Territory registers of legislation (www.legislation.nsw.gov.au, www.legislation.vic.gov.au, www.legislation.qld.gov.au, www.legislation.sa.gov.au, www.legislation.tas.gov.au, www.legislation.wa.gov.au, www.legislation.tas.gov.au, www.legislation.nt.gov.au, www.legislation.act.gov.au)
EWF Committees	Parliamentary committees	**New South Wales, Queensland, Western Australia**	New South Wales Parliament website, Committees (2019) https://www.parliament.nsw.gov.au/committees/listofcommittees/Pages/committees.aspx Queensland Parliament website, Work of committees (2019) https://www.parliament.qld.gov.au/work-of-committees Western Australia Parliamet website, Committees (2019) http://www.parliament.wa.gov.au/parliament/commit.nsf/WCurrentCommitteesByName

Table D2. Legislation cited

Year	Act	Jurisdiction	Number	Date Assented	Source
1880	Country Towns Water Supply and Sewerage Act 1880	NSW	No. XIV	12th July, 1880	AustLII
1896	Mining Development Act 1896	Vic	No. 1461	14th December, 1896	AustLII
1905	Water Act 1905	Vic	No. 2016	12th December, 1905	AustLII
1910	Rights in Conservation and Utilisation of Water Act 1910	Qld	No. 25	7th January, 1911	AustLII
1912	Water Act 1912	NSW	No. 44	26th November, 1912	AustLII
1914	Rights in Water and Irrigation Act 1914	WA	No. 19	22nd September, 1914	AustLII
1915	River Murray Waters Act 1915	Cth	No. 46	15th November, 1915	AustLII
1922	Irrigation Act 1922	Qld	No. 29	18th October, 1922	AustLII
1922	Water Power Act 1922	Qld	No. 20	14th October, 1922	AustLII
1928	Electric Light and Power Act 1928	Vic	No. 3672	12th February, 1929	AustLII
1943	Land and Water Resources Development Act 1943	Qld	No. 38	25th November, 1943	AustLII
1945	State Electricity Commission Act 1945	WA	No. 60	14th February, 1946	AustLII
1949	Snowy Mountains Hydro-electric Power Act 1949	Cth	No. 25	7th July, 1949	AustLII
1957	Water Act 1957	Tas	No. 39	1st November, 1957	AustLII
1965	Soil Conservation (Water Resources) Act 1965	Vic	No. 7265	18th May, 1965	AustLII
1967	Pipelines Act 1967	Vic	No. 7541	17th March, 1967	AustLII
1969	Groundwater Act 1969	Vic	No. 7849	20th May 1969	AustLII
1976	Waterways Conservation Act 1976	WA	No. 131	9th December, 1976	AustLII
1987	Energy and Utilities Administration Act 1987	NSW	No. 103	12th June, 1987	Legislation NSW
1988	Energy and Water Act 1988	ACT	A1988-30	1st July 1988	Legislation ACT
1988	Electricity and Water Act 1988	ACT	A1988-30	1st July 1988	Legislation ACT
1988	Essential Services Act 1988	NSW	No. 41	9th August 1988	AustLII

1989	Water Resources Act 1989	Qld	No. 112	31st October, 1989	AustLII
1989	Water Act 1989	Vic	No. 80	5th December, 1989	AustLII
1990	Water Resources Act 1990	SA	No. 37	3rd May, 1990	AustLII
1993	Electricity Industry Act 1993	Vic	No. 130	14th December, 1993	AustLII
1994	Catchment and Land Protection Act 1994	Vic	No. 52	15th June, 1994	AustLII
1994	Gas Industry Act 1994	Vic	No. 112	20th December, 1994	AustLII
1995	Electricity Supply Industry Act 1995	Tas	No. 58	4th October, 1995	AustLII
1996	Gas Supply Act 1996	NSW	No. 38	25th June 1996	AustLII
1997	Integrated Planning Act 1997	Qld	No. 69	1st December, 1997	Legislation Qld
1997	Water Resources Act 1997	SA	No. 27	10th April, 1997	AustLII
2000	Utilities Act 2000	ACT	No. 63	1st January, 1991	Legislation Act
2000	Water Management Act 2000	NSW	No. 92	8th December, 2000	AustLII
2000	Water Act 2000	Qld	No. 34	13th September, 2000	Legislation QLD
2002	Essential Services Commission Act 2002	SA	No. 14	5th September, 2002	Legislation SA
2003	Food Act 2003	NSW	No. 43	8th Septmeber, 2003	Legislation NSW
2004	Petroleum and Gas Act 2004	Qld	No. 24	12th October 2004	Legislation QLD
2004	Natural Resource Management Act 2004	SA	No. 34	5th August, 2004	Legislation SA
2011	Pastoral Land Act 2011	NT	-	1st March 2011	Legislation NT
2012	Water Services Act 2012	WA	No. 24	3rd September 2012	Legislation WA
2016	Water Act 2016	NT	-	1st July 2016	Legislation NT

Appendix E. EWF Portfolios

The following provides the details of each jurisdiction to support the discussion in Chapter 7.

Commonwealth

Prior to the 1940s, there was no portfolio specific to EWF, and so EWF matters were part of larger portfolios rather than specific sector based portfolios. Energy was part of the Home and Territories portfolio (1923) as well as the Prime Minister's portfolio and the External Affairs portfolio. Water was part of the Home and Affairs portfolio, followed by the Home and Territories portfolio and then the Works and Railways portfolio. Food was under the Trade and Commerce portfolios. Energy and water were both under the Interior portfolio (1932), and energy and food were under the Prime Minister's portfolio and External Affairs portfolio (1935). Both portfolios reflected some degree of integration. The Commerce and Agriculture portfolio (1942) was established under Prime Minister Menzies' Liberal-Country Party Coalition. This portfolio, however, was succeeded by the Primary Industries portfolio (1956), covering agricultural responsibilities. The Shipping and Fuel portfolio (1949) followed by the Fuel, Shipping and Transport portfolio (1950) were both energy-related portfolios. In 1950, the National Development portfolio was created dealing with both energy and water matters up until the 1970s.

Since the 1970s, energy portfolios have included specific energy portfolios including energy, resources and minerals-focussed portfolios and industry-focussed portfolios (in the late 1990s). The first portfolio that was specific to 'energy' was the Minerals and Energy portfolio created in 1972 under Whitlam's Labor government. Energy has also been part of climate change portfolios created in the late 2000s under the Rudd Labor government. Water was part of broad portfolios such as the National Development portfolio, Environment and Conservation portfolio and also agricultural portfolios. The first specific 'water' portfolio at the Commonwealth level was the Environment and Water Resources portfolio created under Howard's Liberal Government in 2007. Water policy was part of the Prime Minister's portfolio. Portfolios for food have typically involved Primary Industry portfolios and Agriculture portfolios along with Fishery and Forestry portfolios, although industry-based portfolios have also dealt with the food sector. Energy matters were previously combined with environmental matters in the Environment and Energy portfolio, created in 2016 by the Turnbull Liberal government until both were separated in 2018. Since 2015, water and food matters have been grouped under the Agriculture and Water Resources portfolio.

The portfolios created for dealing with EWF have varied over time, particularly in terms of the broader agenda. Energy portfolios have been focussed on themes such as national development,

industry and resources as well as climate change and the environment in more recent times. These themes have indicated the importance of energy in the context of environmental and climate policy or vice versa, the importance of environment and climate change in the context of energy policy. Water portfolios have shifted between environment-focused portfolios to agriculture-focussed portfolios. Food portfolios have included agriculture, primary industries and industry portfolios, suggesting an industry focus to food policy as opposed to social welfare policy.

As mentioned above, there were no portfolios specific to EWF prior to 1941, and EWF were matters subsumed under other broader portfolios. The first mixed portfolios included those that grouped energy and water matters such as the Interior portfolio (1931-1939), Works portfolio (1939-1950), National Development portfolio (1950-1972) and another portfolio that grouped energy and food responsibilities, Prime Minister's and External Affairs portfolio (1935-1938). During the 1970s, there were several mixed portfolios combining both energy and water following the National Development portfolio including the Minerals and Energy portfolio, National Resources portfolio, Trade and Resources portfolio, National Development and Energy portfolio and the Resources and Energy portfolio.

The only portfolio to have combined EWF matters was created during Hawke's Labor government in 1987, Primary Industries and Energy portfolio. Although water was not in the title of the portfolio, it was a key responsibility of the corresponding government department. The Resources portfolio, however, was maintained as a separate portfolio. In 1998, under Howard's Liberal government, after just over ten years, the portfolio was separated, with water and food part of the Agriculture, Fisheries and Forestry portfolio and energy, separated and transferred under the Resources and Energy portfolio.

Water and food were managed together in a single portfolio until 2005 when water was transferred to the Climate Change and Water portfolio under Rudd's first Labor Government. Energy and water were combined under the Climate Change, Energy Efficiency and Water in the following Gillard Labor government. In Rudd's second government, EWF were however separated into different portfolios. Energy was under the Resources and Energy portfolio and the Climate Change and Energy Efficiency portfolio, water was under the Sustainability, Environment, Water, Population and Communities portfolio while food matters remained under the Agriculture, Fisheries and Forestry portfolio. Water remained under environment portfolios until 2015. Industry portfolios dealt with energy and some industry-related food matters.

By 2015, EWF matters were rearranged under the Turnbull Liberal Government. Water was returned to the agriculture portfolio to form the Agriculture and Water Resources portfolio and energy was combined with the Environment portfolio (previously responsible for water) to form

the Energy and Environment portfolio. In 2018, under the Morrison Liberal government, energy was separated from the environment.

New South Wales

The first energy portfolio in the state was created for mines in 1872. The following energy portfolios included a range of specific energy, mining, resources, technology and utilities focussed portfolios. Electricity was under the Local Government portfolio from the 1920s. The first water portfolio was created for conservation in 1944, and in 1975, the Water Resources portfolio was created - the first portfolio using 'water' in the title. Other water portfolios included the Natural Resources portfolio, Land and Water Conservation portfolio, Climate Change, Environmental and Water portfolio along with utility portfolios, the Water Utilities portfolio and the Energy and Utilities portfolio. Food-related portfolios included mostly agricultural and primary industry portfolios including a Food Production portfolio (1953). Agriculture portfolios were at times combined with Fisheries or Rural Affairs portfolios.

There were few mixed portfolios in NSW, mostly grouping two sectors rather than three. The first portfolio that grouped energy and food-related responsibilities was the Mines and Agriculture portfolio from 1891 until it was separated into two separate portfolios (Mines portfolio and Agriculture portfolio) in 1907. Grouping energy and water responsibilities were the Local Government and Public Works portfolios during the 1920s, the Local Government and Water Resources portfolio (1986) and the Energy and Utilities portfolio (2003-2005, 2017) during the Carr Labor government and again during the current Berejiklian Liberal government. There was no portfolio covering matters of all three EWF areas simultaneously.

Victoria

As seen in the previous section, Victoria was the first state to create EWF-related portfolios. Energy portfolios ranged from mining portfolios during the pre-federation era, electricity portfolios in the 1920s, as well as other energy-specific portfolios such as the Fuel and Power portfolio from the 1960s followed by portfolios for Minerals and Energy, and Energy and Resources, to broad portfolios such as the Industry, Technology and Resources portfolio (1989-1989), Manufacturing and Industry Development portfolio (1992) and the most recent mixed Environment and Climate Change portfolio and Environment, Climate Change and Water portfolio. Water portfolios have included Water Supply portfolios since the pre-federation era, Water Resources portfolios during the 1980s, Natural Resources portfolios from the 1990s as well as the recent Climate Change and Water portfolios. Food-related portfolios have included agriculture portfolios since the pre-federation era, Agriculture and Rural Affairs portfolios during the 1980s, Food and Agriculture portfolio (1992-1996), Agriculture and Resources portfolio

(1996-1998) and the Agriculture and Food Security portfolio (2010-2014). It was interesting to note the importance of food security as part of the portfolio responsibilities.

There were few instances of mixed portfolios across the periods. The first portfolio grouping energy and water-related responsibilities was the Mines and Water Supply portfolio (1880-1881, 1901-1904). Grouping energy and food-related areas was the Mines and Agriculture portfolio (1883-1885), and grouping water and food-related areas was the Public Works, Agriculture and Water Supply portfolio (1881-1883). Mines portfolios also included groundwater responsibilities. Portfolios in Victoria in the fourth and fifth period were largely separate with only three mixed portfolios, the Agriculture and Resources portfolio combining energy and food-related responsibilities during the Kennett Liberal Ministry (1996-1998), the Environment and Climate Change portfolio (2007-2014) and the Environment, Climate Change and Water portfolio (2014-2017) under the Andrews Labor Ministry. Portfolios were otherwise separated.

Queensland

Energy portfolios included specific energy portfolios for mines, electricity, resources and natural resources. Water portfolios included irrigation, conservation and water resources portfolios. From 1989, the Water Resources portfolio was under the Primary Industry portfolio but was transferred later to the Natural Resources portfolio in 1996. Food matters were represented by primary industry and agriculture-based portfolios.

There were few examples of mixed portfolios combining EWF matters. Mixed portfolios included the Irrigation portfolio from the 1950s (combining water and food matters), Local Government and Electricity portfolio (combining energy and water) in the late 1960s and the Primary Industries portfolios combining water and food (1989-1996). In the fifth period, mixed portfolios were those combining energy and water, for example, the Natural Resources, Mines and Energy portfolio and the Energy and Water portfolio. There was no mixed portfolio covering all three EWF areas.

Currently, mixed portfolios include the Natural Resources, Mines and Energy portfolio which combines energy and water and the Agricultural Industry Development and Fisheries portfolio responsible for food. Water responsibilities were absorbed into other portfolios.

South Australia

In the earlier periods, energy portfolios were mostly mining portfolios until the 1970s when the first ‘energy’ specific portfolio was created. Water portfolios included those for water supply, public works, irrigation and later in the 1970s, the Water Resources portfolio, Water Security portfolio, River Murray portfolio and the Environment and Heritage portfolio. It is important to note the portfolio for water security (2006-2009) which reflected water security concerns at the

time. In earlier periods, food-related portfolios were agriculture portfolios until the 1970s when combined with fisheries portfolios, then becoming primary industry portfolios. In 2004, the Agriculture, Food and Fisheries portfolio was created.

Only a few mixed portfolios existed across the five periods. The first mixed portfolio was the Agriculture and Irrigation portfolio (1912-1915) created during the Liberal Peake ministry. The following mixed portfolios included the Primary Industries, Natural Resources and Regional Development portfolio (1997-1999) combining water and food and the Primary Industries and Resources portfolio (2000-2001) combining energy and food. Currently EWF are represented by separate portfolios.

Tasmania

Energy portfolios included mining-related portfolios, resources and energy specific portfolios as well as other broader economic portfolios. Unlike other states, Tasmania created a portfolio for hydroelectricity matters and recently a portfolio for sustainable transport and alternative energy. Water portfolios were also associated with hydroelectricity portfolios, and in 1978, the Water Resources portfolio was created. Food-related portfolios were included agriculture, fisheries or primary industry portfolios.

There were several mixed portfolios across the five periods. Combining energy and water were portfolios for hydroelectricity matters from the late 1920s. Combining energy and food was the Primary Industry, Fisheries and Energy portfolio (1992). Combining water and food was the Primary Industries & Water portfolio (2004-2006 and 2014-present), and in 2008, unlike other states, a mixed portfolio for EWF was created, the Primary Industries, Water & Energy portfolio.

Western Australia

Energy portfolios included mines portfolios since the pre-federation era, electricity portfolios since 1959 and from the 1970s, fuels, resources and petroleum portfolios. Water portfolios included various portfolios including the Water Supplies, Sewerage and Drainage, Country Water Supplies portfolio (1913), and from the 1980s, the Water Resources portfolio. Food-related portfolios included agriculture, fisheries and primary industry portfolios.

There were several mixed portfolios during the periods. The first mixed portfolio was the Mines and Water Supply, Sewerage and Drainage portfolio (1914-1916) combining energy and water manners. Other mixed portfolios combined energy and food-related areas including the Mines and Agriculture portfolio (1924-1927), Mines and Fisheries portfolio (1953-1954) and Agriculture and Electricity portfolio (1961-1971). There was no mixed portfolio combining EWF.

Northern Territory

Since self-government, energy portfolios included specific resource, mines and energy portfolios. Water matters were under larger portfolios such as the Conservation portfolio, Power and Water portfolio, Essential Services portfolio (both combining energy and water), Natural Resources, Environment and Heritage portfolio and Land Resource Management portfolio. Food portfolios included primary industry portfolios.

Mixed portfolios included the Power and Water portfolio (1995-1997), Essential Services portfolio (1998-1999), the Primary Industry, Fisheries and Resources portfolio (2009-2012) and current Primary Industry and Resources portfolio.

Australian Capital Territory

In the ACT, EWF matters were often subsumed into broader portfolios. For example, energy matters were under portfolios including urban services, planning, environment, sustainable and climate based portfolios. The only specific energy portfolio was between 2008 and 2011. Water was similarly under broad portfolios including urban services, planning, environment, climate change and sustainable development portfolios. A portfolio for the Environment, Climate Change and Water was created in 2009. There was no specific portfolio for food, or agriculture. Food responsibilities were mostly part of the health portfolio during the period.

EWF matters were combined under broader portfolios, such as the Housing and Urban Services portfolio, the Finance and Urban Services portfolio during the late 1980s and early 1990s, and the more recent Regulatory Services portfolio, responsible for regulation across all three sectors.

Other mixed portfolios included those that grouped energy and water responsibilities including the Urban Services portfolio, the Planning portfolio and the Environment and the Environmental and Sustainable Development portfolios, and a portfolio grouping water and food-related responsibilities under the Environment, Land and Planning portfolios.

Appendix F. Ministerial responsibilities in EWF

The following provides the details of each jurisdiction to support the discussion in Chapter 7.[28]

Commonwealth

Over the periods, there was no minister responsible for multiple portfolios and portfolios were allocated to single ministers. Cross-sectoral responsibility depended on how portfolios were created. Ministerial responsibilities were in line with portfolios reflecting the cross-sectoral responsibilities of only mixed portfolios.

Most of the years served by a minister with cross-sectoral responsibilities were served by ministers responsible for mixed energy and water portfolios. These ministers included the Minister for Interior, Minister for Works, Minister for National Development (from the Menzies government to the Fraser government), Minister for Natural Resources, Minister for Trade and Resources, Minister for National Development and Energy, Minister for Resources and Energy (from the Fraser government to the Hawke government) as well as Minister for Climate Change and Water followed by the Minister for Climate Change and Energy Efficiency and Water (of the Rudd and Gillard governments).

Ministers with cross-sectoral responsibilities for energy and food were evident during the third and fifth period including the Prime Minister and Minister for External Affairs during the 1930s and during the 2013s, ministers responsible for industry portfolios. The ministers responsible for food, however, have differed. Early ministers were responsible for administering the many food-related acts while more recent ministers have been responsible for food manufacturing matters.

Ministers with cross-sectoral responsibilities across water and food were apparent in the last two periods including the Minister for Agriculture, Fisheries and Forestry and the Minister for Agriculture and Waters Resources, both reflecting integrated responsibilities for agriculture and water resources. Table F1 shows the number of mixed sector ministerial designations created throughout the five periods and used by which government.

Although, Labor and Non-Labor ministries during the periods included at least one minister with cross-sectoral responsibilities, Non-Labor governments had the most mixed sector ministerial

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[28] **Key for Political Parties used for tables*:* ALP:** Australian Labor Party**; CLP:** Country Liberal Party; **CON:** Conservative Party; **COU:** Country Party; **CPNP:** Country & Progressive National Party, **ER:** Electoral Reform League, **FT:** Free Trade; **LCL/P:** Liberal and Country League/Party, **LIB:** Liberal Party; **LNP:** Liberal National Party; **MIN:** Ministerialists; **NAT:** National/ Nationalist Party; **NAT LAB:** National Labor Party; **NAT PROG:** Nationalist-Progressive Party; **PROT:** Protectionist Party; **REF:** Reform; **SUP:** Support from parliamentary factions and independents; **UAP:** United Australia Party; **UCP:** United Country Party , Source: Australian Politics and Elections Database The University of Western Australia

designations. Across all periods, only under the Hawke Labor ministry was there a minister responsible for EWF (Minister for Primary Industries and Energy).

Table F1. Ministerial designations at Commonwealth level

Ministerial Designation	ALP	Country	Liberal	UAP	TOTAL
ENERGY-FOOD	**2**	**2**	**3**	**2**	**5**
Min. External Affairs	1	1		1	
Prime Minister			1		
Min. Industry			1		
Min. Industry and Science			1		
Min. Industry, Innovation and Science	1	1		1	
ENERGY-WATER	**5**	**3**	**4**	**2**	**11**
Min. Interior	1				
Min. National Development	1		1		
Min. Works				1	
Min. National Development and Energy		1	1		
Min. National Resources			1		
Min. Resources and Energy			1		
Min. Trade and Resources	1	1		1	
Min. Climate Change and Water	1	1			
Min. Climate Change, Energy Efficiency and Water	1				
WATER-FOOD			**2**		**2**
Min. Agriculture, Fisheries and Forestry			1		
Min. Agriculture and Water Resources			1		
ENERGY-WATER-FOOD	**1**		**1**		**1**
Min. Primary Industries and Energy	1		1		
TOTAL	**9**	**5**	**10**	**4**	**19**

New South Wales

Ministers were allocated multiple portfolios as well as allocated mixed portfolios. Most of the years served by a minister with cross-sectoral responsibilities were served by a minister responsible for both energy and water. Table F2 shows the number of mixed sector ministerial designations created throughout the period and used by which government. Table F2 furthermore shows that the majority of mixed sector ministerial designations combined energy and water responsibilities.

Ministers during earlier periods responsible for energy and water were those responsible electricity and water systems (Ministers for Local Government) and those responsible for mining and water (groundwater). In the fifth period, ministers responsible for energy and water included those responsible for the Energy and Utilities portfolio, both mineral resource or energy portfolios and Ports and Waterways portfolios, reflecting an emphasis on energy and water-related

infrastructure. Ministers responsible for energy and food were those responsible for both mining and agricultural portfolios seen in all periods. Ministers responsible for both water and food included those responsible for agriculture and conservation or water resources related portfolios, first seen in the 1960s, and during both fourth and fifth periods.

All cabinet ministries had ministers with cross-sectoral responsibilities apart from O'Farrell's Liberal Ministry (2011-2014). While EWF-related portfolios were mostly separated from each other, there were various instances where individual ministers were responsible for more than one portfolio, hence indicating some integration between EWF.

The only minister responsible for EWF simultaneously was during the Iemma Labor government when a single minister was allocated three separate portfolios, with multiple roles as Minister for Natural Resources, Minister for Primary Industries and Minister for Mineral Resources (2005-2007). Other ministers had only partially integrated responsibilities.

Table F2. Ministerial designations in NSW

Ministerial Designation	ALP	FT	LIB	NAT	PROT	SUP	UAP	TOTAL
ENERGY-FOOD	**3**	**2**	**2**		**1**			**6**
Min. Mineral Resources, Min. Fisheries	1							
Min. Mines, Minister of Agriculture and Fisheries			1					
Min. Primary Industries, Min. Energy, Min. Mineral Resources, Min. State Development	1							
Sec. Lands and Sec. Mines, Min. Agriculture, Min. Food Production	1							
Sec. Mines and Agriculture		1	1		1			
Sec. Mines, Min. Agriculture		1						
ENERGY-WATER	**12**		**7**	**5**			**4**	**16**
Min. Energy and Utilities	1							
Min. Energy, Min. Conservation and Land Management			1					
Min. Energy, Min. Local Government and Cooperatives			1					
Min. Energy, Min. Ports and Waterways	1							
Min. Energy, Min. Water Resources	1							
Min. Local Government	1		1	1			1	
Min. Local Government and Housing	1							
Min. Local Government and Water Resources	1							
Min. Local Government, Min. Planning			1					
Min. Mineral and Forest Resources, Min. Ports and Waterways	1							
Min. Mines, Min. Conservation			1					
Min. Public Works	1		1					
Min. Resources, Min. Energy and Utilities			1					
Sec. Mines, Min. Local Government	1			1				

Sec. Public Works	1			1			1	
Sec. Public Works, Min. Local Government	1						1	
WATER-FOOD	**2**		**3**					**5**
Min. Agriculture, Min. Conservation	1							
Min. Agriculture, Min. Land and Water Conservation	1							
Min. Agriculture, Min. Water Resources			1					
Min. Primary Industries, Min. Lands and Water			1					
Min. Primary Industries, Min. Regional Water, Min. Trade and Industry			1					
ENERGY-WATER-FOOD	**1**							
Min. Natural Resources, Min. Primary Industries, Min. Mineral Resources	1							
TOTAL	**18**	**2**	**13**	**5**	**1**	**1**	**4**	**27**

Victoria

Ministers were allocated multiple portfolios as well as combined portfolios indicating cross-sectoral responsibilities. The majority of years served by a minister with cross-sectoral responsibilities were served by those responsible for energy and water. Table F3 shows the number of mixed sector ministerial designations created throughout the five periods and used by which government.

Ministers with energy and water responsibilities were often those responsible for mining portfolios particularly in the early periods (including groundwater responsibilities) and Water Supply portfolios. From the mid-1930s to the mid-1940s, there was also a minister responsible for Water Supply and Electrical Undertaking portfolios grouping both water and electricity. Responsible for energy and water portfolios was the Minister for Industry, Technology and Resources (1983-1991) and the more recent ministers responsible for Environment and Climate Change portfolios (2007-2016).

Table F3. Ministerial designations in Victoria

Ministerial Designation	ALP	CON	COU	LIB	LIBC	MIN	NAT	RE	SUP	UAP	UCP	TOTAL
ENERGY-FOOD	**1**	**1**	**1**	**1**						**1**	**1**	**3**
Min. Agriculture and Resources				1								
Min. Agriculture, Min. Mines	1		1							1	1	
Min. Mines and Agriculture		1										
ENERGY-WATER	**6**	**3**	**1**	**5**	**1**	**2**	**3**	**2**	**1**	**2**	**2**	**14**
Min. Environment and Climate Change	1			1								

Min. Environment, Climate Change and Water	1											
Min. Minerals and Energy, Min. Mines, Min. Water Supply	1											
Min. Minerals and Energy, Min. Water Supply	1											
Min. Mines	1		1	1			1				1	
Min. Mines and Forests				1				1				
Min. Mines and Water Supply				1		1		1				
Min. Mines, Commissioner of Public Works							1			1		
Min. Mines, Min. Water Supply		1		1	1							
Min. Public Works		1				1			1			
Min. Public Works and Water Supply		1										
Min. Railways, Min. Mines							1					
Min. Water Supply, Minister in Charge of Electrical Undertakings										1	1	
Min. Water, Min. Environment and Climate Change	1											
WATER-FOOD	**1**			**2**		**1**	**2**	**1**				**5**
Min. Agriculture and Food Security, Min. Water				1								
Min. Agriculture, Min. State Development and Decentralisation, Min. Water Supply	1											
Min. Water Supply, Minister in Charge of the Wheat Scheme							1					
Min. Water Supply, Min. Agriculture				1			1	1				
Min. Public Works, Agriculture and Water Supply						1						
TOTAL	**8**	**4**	**2**	**8**	**1**	**3**	**5**	**3**	**1**	**3**	**3**	**22**

Ministers with energy and food responsibilities were those responsible for both mining and Agriculture portfolios seen in the pre-federation era, during the 1930s, 1940s to the 1950s. A Minister for Agriculture and Resources served during the Kennet Liberal government (1996-1999). With responsibilities for mines, the Minister for Agriculture and Resources was also responsible for dealing with groundwater matters, thus also responsible for all three sectors. Ministers responsible for water and food were those responsible for Agriculture and Water Supply

portfolios (1881-1883, 1907-1917, 1921-1924, 1953-1955). In 2010, a minister was responsible for both the Agriculture and Food Security portfolio and Water portfolio.

Although EWF portfolios were largely separated, the ability of ministers to assume dual minister roles enabled integration of EWF responsibilities. While, Labor and Non-Labor governments had cross-sectoral ministers for most of the years, most ministers were during Non-Labor governments.

Queensland

There were few ministers with cross-sectoral responsibilities. The majority of the years served by a minister with cross-sectoral responsibilities were served by those responsible for water and food. Table F4 shows the number of mixed sector ministerial designations created throughout the five periods and used by which government. The table furthermore shows that the majority of mixed sector ministerial designations combined energy and water responsibilities.

Table F4. Ministerial designations in Queensland

Ministerial Designation	ALP	COU	LNP	MIN	NAT	SUP	TOTAL
ENERGY-FOOD					1		1
Min. Mines and Energy, Min. Primary Industries					1		
ENERGY-WATER	9	2	4	1			13
Min. Energy and Water Supply	1		1				
Min. Energy and Water Utilities	1		1				
Min. Energy, Biofuels and Water Supply	1						
Min. Environment and Heritage Protection			1				
Min. Local Government and Conservation		1					
Min. Local Government and Electricity		1					
Min. Mines and Energy, Min. Natural Resources	1						
Min. Natural Resources and Mines	1		1				
Min. Natural Resources, Mines and Energy	1						
Min. Natural Resources, Mines and Minister Assisting the Premier on Water	1						
Min. Natural Resources, Mines and Water	1						
Sec. Public Works	1						
Sec. Public Works and Mines				1			
WATER-FOOD	4	1			1		5
Min. Primary Industries	1						
Min. Primary Industries, Fisheries and Forestry	1				1		
Min. Public Lands and Irrigation		1					
Sec. Public Lands	1						
Sec. Public Lands and Irrigation	1						
ENERGY-WATER-FOOD	1					1	2
Min. Lands and Works						1	
Sec. Public Lands and Sec. Mines	1						

TOTAL	14	3	4	1	2	1	21

Almost all governments since the 1930s had at least one cross-sectoral minister. Ministers responsible for energy and water included those responsible for Local Government portfolios (including the Local Government and Electricity portfolio) in the late 1960s and early 1970s and from the beginning of the 2000s, ministers responsible for both energy and water included those responsible for Natural Resources portfolios as well as Energy and Water portfolios, suggesting a shift towards a resources focus.

Ministers responsible for energy and food matters included Ministers responsible for mines and primary industry portfolios only during the 1980s during the National Party. Ministers responsible for water and food, as mentioned, included those responsible for irrigation from the 1950s to the 1960s as well as ministers responsible for public lands- and primary industries-related portfolios (1989-1996). During the last period, ministers with cross-sectoral responsibilities were those responsible for various energy and water portfolios. Agriculture was a separate responsibility.

South Australia

Despite mostly separate portfolios, there were many instances where ministers were allocated multiple portfolios, hence reflecting some integration across EWF. The majority of the years served by a minister with cross-sectoral responsibilities were served by those responsible for water and food. Table F5 shows the number of mixed sector ministerial designations created throughout the period and used by which government. The majority of ministerial designations combined water and food responsibilities.

Ministers that were both responsible for energy and water were responsible for mines portfolios and other water-related portfolios including public works, and marines portfolios. Ministers responsible for mining areas were also responsible for groundwater matters. Ministers responsible for energy and food were those responsible for mining, resources, agriculture or primary industries-related portfolios. There were a number of ministers who had both water and food-related responsibilities including the minister responsible for agriculture, irrigation and public works portfolios. The ministers responsible for water and food were those responsible for irrigation portfolios, from 1912 up until the 1980s. In 1997, a minister was responsible for the Primary Industries, Natural Resources & Regional Development portfolio, responsible for both water and food.

Unlike the other states, some ministers were allocated responsibilities covering all three EWF areas. These included the Minister for Agriculture, Irrigation and Mines (1920-1922), the Minister for Irrigation and Mines (1933-1933) and the minister responsible for the Mineral Resources

Development portfolio and the Agriculture, Food and Fisheries portfolio. By the end of the period, EWF were the responsibilities of separate ministers.

Table F5. Ministerial designations in SA

Ministerial Designation	ALP	CON	LCL	LIB	TOTAL
ENERGY-FOOD	1			3	4
Min. Primary Industries and Resources				1	
Min. Primary Industries, Min. Minerals and Energy				1	
Min. Mines, Min. Agriculture				1	
ENERGY-WATER	4			5	9
Com. Crown Lands, Min. Mines, Min. Marine				1	
Com. Public Works, Min. Mines				1	
Com. Public Works, Min. Mines, Min. Marine				1	
Min. Industry, Min. Mines, Min. Marine	1				
Min. Mines, Min. Marine				1	
Min. Mines, Min. Marine, Min. Immigration, Min. Local Government	1				
Min. Minerals & Energy, Min. Mineral Resources and Energy	1			1	
Min. Mineral Resources Development	1				
WATER-FOOD	5	1	4	8	13
Com. Crown Lands, Min. Irrigation			1		
Com. Crown Lands, Min. Repatriation, Min. Irrigation			1		
Com. Public Works, Min. Agriculture		1		1	
Com. Public Works, Min. Marine, Min. Irrigation				1	
Min. Primary Industries, Natural Resources and Regional Development				1	
Min. Agriculture and Irrigation				1	
Min. Agriculture, Min. Irrigation	1			1	
Min. Irrigation	1		1	1	
Min. Lands, Min. Irrigation	1				
Min. Lands, Min. Repatriation, Min. Irrigation	1		1		
Min. Lands, Min. Repatriation, Min. Irrigation, Min. Agriculture, Min. Forests	1				
Min. Marine, Min. Irrigation				1	
Min. Water Resources, Min. Irrigation				1	
ENERGY-WATER-FOOD	1			1	2
Min. Agriculture, Min. Irrigation, Min. Mines	1			1	
Min. Mines, Min. Irrigation	1				
Min. Mineral Resources Development, Min. Agriculture, Food and Fisheries	1				
TOTAL	9	1	4	16	25

Tasmania

There were many instances where ministers were allocated multiple portfolios, hence reflecting some integration across EWF. The majority of the years served by a minister with cross-sectoral

responsibilities were served by those responsible for energy and water. Table F6 shows the number of mixed sector ministerial designations created throughout the period and used by which government. Ministerial designations combined energy and water, and EWF.

Ministers responsible for energy and water were those responsible for hydroelectricity-related portfolios, mines portfolios and water supply portfolios. Ministers responsible for energy and food were responsible for mining and agriculture, or primary industry-related portfolios seen in the 1980s. Ministers responsible for water and food were those responsible for primary industry and water resources portfolios during the late 1970s.

Table F6. Ministerial designations in Tasmania

Ministerial Designation	ALP	LIB	MIN	NAT	SUP	TOTAL
ENERGY-FOOD	**1**	**3**				**4**
Min. Energy, Min. Primary Industry and Fisheries		1				
Min. Mines, Min. Sea Fisheries		1				
Min. Primary Industry, Fisheries and Energy		1				
Min. Lands and Works, Min. Agriculture, Min. Mines	1					
ENERGY-WATER	**4**	**3**		**1**		**7**
Min. administering the Hydro-Electric Commission Act 1944	1	1				
Min. administering the Hydro-Electric Commission Act 1944, Min. Mines	1					
Min. administering the Hydro-Electric Department				1		
Min. Lands and Works, Min. Mines, Min. administering the Hydro-Electric Department	1					
Min. Public Works and Water Supplies	1					
Min. Works		1				
Min. Works, Min. Mines		1				
WATER-FOOD	**2**	**3**				**5**
Min. Primary Industries and Water	1	1				
Min. Primary Industry, Min. Sea Fisheries, Min. Water Resources		1				
Min. Primary Industry, Min. Water Resources		1				
Min. Primary Industry, Min. Water Resources, Min. the Environment	1					
ENERGY-WATER-FOOD	**6**	**0**	**0**	**1**		**7**
Min. administering the Commerce and Industry Division of Department of Agriculture, Min. administering the Hydro-Electric Commission Act 1944	1					
Min. administering the Hydro-Electric Department, Min. administering the Agricultural Bank	1			1		
Min. Primary Industries and Water, Min. Energy	1					
Min. Primary Industries and Water, Min. Energy and Resources	1					
Min. Primary Industries, Water and Energy	1					
Min. Primary Industries, Water and Energy, Min. Energy and Resources	1					
TOTAL	**13**	**9**	**0**	**2**	**0**	**23**

In Tasmania, there were also several instances where ministers had responsibilities for all sectors. These included the Minister administering the Hydro-Electric Department and the Agricultural Bank during the 1930s, the Minister administering the Commerce and Industry Division of Department of Agriculture and Administering the Hydro-Electric Commission Act 1944 in the 1940s and ministers responsible for primary industries, water and energy portfolios (2006-2014). Currently, there is one minister with cross-sectoral responsibilities; the Minister for Primary Industries and Water.

Western Australia

Ministers had cross-sectoral responsibilities through the responsibility of mixed portfolios as well as multiple portfolios. The majority of the years served by a minister with cross-sectoral responsibilities were served by those responsible for energy and food. Table F7 shows the number of mixed sector ministerial designations created throughout the period and used by which government. The majority of ministerial designations combined energy and food portfolios.

EWF matters were largely separated at the portfolio level. The allocation of mixed portfolios determined cross-sectoral ministerial responsibilities. Ministers responsible for energy and water matters were few and were those responsible for mostly mines and electricity portfolios and water supply and resources portfolios. The first was the Minister for Mines & Water Supply, Sewerage & Drainage (1914-1916), followed by minister responsible for the Works, Water Supplies portfolio and the Electricity portfolio (1971) and the minister responsible for the Water Resources portfolio and the Energy portfolio (2006).

Table F7. Ministerial designations in WA

Ministerial Designation	ALP	LCL	Liberal	TOTAL
ENERGY-FOOD	**3**	**1**	**2**	**6**
Min. Agriculture and Electricity		1		
Min. Lands, Min. Labour and Agriculture, Min. Mines and Health			1	
Min. Mines and Agriculture	1			
Min. Mines and Fisheries	1			
Min. Mines and Petroleum, Min. Fisheries			1	
Min. Mines, Min. Fisheries	1			
ENERGY-WATER	**3**			**3**
Min. Mines and Water Supply, Min. Sewerage and Drainage	1			
Min. Water Resources, Min. Energy	1			
Min. Works, Min. Water Supplies, Min. Electricity	1			
WATER-FOOD	**3**	**1**		**4**
Min. Agriculture, Min. Water Resources	1			
Min. Water, Min. Fisheries	1			

Min. Works, Min. Water Supplies, Min. Fisheries and Fauna		1		
Min. Goldfields and Agriculture Water Supplies	1			
TOTAL	**9**	**2**	**2**	**13**

Ministers responsible for energy and food were responsible for mining and electricity portfolios and agriculture portfolios. Ministers included the Minister for Mines and Agriculture (1924-1927) and Minister for Agriculture and Electricity (1961-1971). The Minister for Agriculture and Electricity was the longest serving cross-sectoral minister. Other Ministers were responsible for Mines and Fisheries portfolio such Minister of Mines & Fisheries (1953-1954). Ministers responsible for water and food although few, included the ministers responsible for agriculture and water supplies portfolios. No minister was responsible for EWF simultaneously.

Northern Territory

At the beginning of self-government from 1974, EWF responsibilities were unclear. The first executive members were responsible for primary industry and resource development. The majority of the years served by a minister with cross-sectoral responsibilities were served by those responsible for both energy and water and energy food at the same time. Table F8 shows the number of mixed sector ministerial designations created throughout the period and used by which government. The majority of ministerial designations combined energy and food portfolios.

Although portfolios were mostly separate, integration was evident in the allocation of multiple portfolios to an individual minister. Ministers responsible for both energy and food included those responsible for mines, energy and primary industries portfolios (1983-1984, 1986-1987, 2003-2009). Ministers responsible for energy and water included those responsible for the Power and Water portfolio (1997), the Essential Services portfolio (from 1998), the Mines and Energy portfolio and other water-related portfolios in the late 1980s. Ministers responsible water and food were those responsible for primary production and conservation portfolios during the 1980s. In 2017, a minister was responsible for both the Land and Resource Management portfolio and the Primary Industry and Fisheries portfolio, responsible for both water and food.

Table F8. Ministerial designations in NT

Ministerial Designation	ALP	Country Liberal	TOTAL
ENERGY-FOOD	3	2	5
Min. Mines and Energy, Min. Primary Industry and Fisheries	1	1	
Min. Mines and Energy, Min. Primary Production		1	
Min. Primary Industry and Resources	1		
Min. Primary Industry, Fisheries and Resources	1		
ENERGY-WATER	2	5	6
Min. Essential Services	1	1	
Min. Lands, Planning and Environment, Min. Mines and Energy		1	
Min. Mines and Energy, Min. Conservation		1	
Min. Mines and Energy, Min. Power and Water		1	
Min. Power and Water		1	
Min. Renewables and Essential Services	1		
WATER-FOOD		4	4
Min. Conservation, Min. Ports and Fisheries, Min. Primary Production		1	
Min. Conservation, Min. Primary Production		1	
Min. Land Resource Management, Min. Primary Industry and Fisheries		1	
Min. Primary Production and Conservation		1	
ENERGY-WATER-FOOD	3	1	3
Min. Essential Services, Min. Land Resource Management, Min. Mines and Energy, Min. Primary Industry and Fisheries	1	1	
Min. Essential Services, Min. Primary Industry and Fisheries	1		
Min. Essential Services, Min. Primary Industry, Fisheries and Resources, Min. Natural Resources, Environment and Heritage	1		
TOTAL	**8**	**12**	**17**

There were, however, some instances under which a single minster had EWF responsibilities. These ministers included the minister responsible for the Essential Services portfolio and the Primary Industry and Fisheries portfolio (2002), the minister responsible for the Essential Services portfolio, Primary Industry, Fisheries and Resources portfolio, Natural Resources, Environment and Heritage portfolio (2012) followed by the minister responsible for the Essential Services, Land Resource Management, Mines and Energy, and Primary Industry and Fisheries portfolios (2012-2016).

Australian Capital Territory

Table F9 shows the number of mixed sector ministerial designations created throughout the period and used by which government. Ministerial designations were those that grouped EWF. For almost the entire period was there a minister with cross-sectoral responsibilities For almost the entire period.

Table F9. Ministerial designations in ACT

Ministerial Designation	ALP	LIB	Total
ENERGY-WATER	7	1	7
Min. Climate Change and Sustainability	1		
Min. Energy, Min. Environment, Climate Change and Water	1		
Min. Planning	1		
Min. the Environment	1		
Min. the Environment and Sustainable Development	1		
Min. Urban Services	1	1	
Treasurer	1		
WATER-FOOD	2	1	2
Min. Environment, Land and Planning	1	1	
Min. Environment, Min. Health	1		
ENERGY-WATER-FOOD	7	2	7
Chief Minister	1		
Min. Finance and Urban Services	1	1	
Min. Housing and Urban Services	1	1	
Min. Planning, Min. Health	1		
Min. Regulatory Services	1		
Min. the Environment and Climate Change, Min. Health	1		
Min. the Environment, Min. Health	1		
TOTAL	16	4	16

The experience in the ACT is that EWF have rarely been completely separated from each other and the integration of EWF responsibilities portfolio level was matched by corresponding ministers. During the Liberal Kaine ministry (1989-1991), the Minister for Housing and Urban Services was responsible for EWF matters. In 1991, energy and water were the responsibility of the Minister for Urban Services, while water and food matters were the responsibility of the Minister for Environment, Land and Planning. This arrangement lasted towards the end of the 1990s. In 1998, agriculture and rural matters were no longer stated in the main matters dealt with by ministers[29]. Food matters were seen in the administration of the Food Act by the Health Department. Energy and water responsibilities spread across a number of ministerial portfolios and departments, department of environment, planning treasury and the Chief Minister's department. After the Liberal Humphries ministry ending in 2001, all ministries were Labor governments.

[29] As observed in Australian Capital Territory Government Gazettes until 1998.

The period from 2000 up until the present continued to demonstrate cross-sectoral responsibilities, with EWF often combined under one minister. From 2001 to 2004, under the Stanhope Labor government, energy and water were joint responsibilities of the Treasury and the Minister for Planning. From 2004 to 2006, one minister was responsible for both health and planning, capturing all three EWF responsibilities.

Energy and water continued to be linked throughout the period. In 2008, the Minister for Energy was established, separating energy and water into two portfolios, the Energy portfolio and the Environment, Climate Change and Water portfolio. In 2011, the Minister for Environment and Sustainable Development was responsible for energy and water. Until 2016, energy and water were combined under the environment and followed by the environment and climate portfolio. From 2015, the Chief Minister played a cross-sectoral role, responsible for energy water and food regulation. The Minister for Regulatory services then replaced the Chief Minister in this role. From 2017 until the present, EWF ministers had included the Minister for Climate Change and Sustainability, responsible for energy policy, Minister for Regulatory Services responsible for EWF regulation and the Minister for Environment and Heritage, responsible for water. Water and energy were only separated in 2016 between the Minister for Climate Change and Sustainability and the Minister for Environment and Heritage.

Appendix G. EWF Organisations

The following provides the details of each jurisdiction to support the discussion in Chapter 7.

Commonwealth

A number of organisations including government departments and other agencies had cross-sectoral responsibilities. Government departments were in line with portfolios during the five periods. Table G1 lists all government departments with cross-sectoral responsibilities.

Table G1. Commonwealth Government departments with multiple sector responsibilities

COMMONWEALTH	YEARS	EWF RESPONSIBILITIES	E	W	F
Prime Minister's Dept. & External Affairs Dept.	1923-1939	• Oil, relations with Commonwealth Oil Refineries Ltd • Administration of: Oil Agreement Act 1920, Wheat Commission Act 1935 (1936), Petrol Commission Act 1933 (1938)	✓		✓
Dept. Interior	1932-1939	• Oil investigation & encouragement of oil prospecting • Administration of: River Murray Waters Act 1915 (until April 1939 & then from November 1939)	✓	✓	
Prime Minister's Dept.	1939-1947	• Administration of the Oil Agreement Act 1920 • Oil, relations with Commonwealth Oil Refineries Ltd (1925) • Administration of: Petrol Commission Act 1933 (1939), Wheat Commissions Act 1935 (1939)	✓		✓
Dept. National Development	1950-1972 1978-1979	• Evaluation & development of natural resources (energy resources & water) • Administration of various energy-related legislation inc. Atomic Energy Act, Coal Industry Act, Coal Production Act, Liquid Fuel Act, Petroleum Acts, Snowy-Mountains Hydro-electric Power Act • Administration of various water-related legislation inc. River Murray Waters Act	✓	✓	
Dept. Minerals & Energy	1972-1975	• Evaluation & balanced development of mineral & energy resources having regard to future requirements • Administration of a number of energy-related legislation inc. Snowy Mountains Hydro-electric Acts	✓	✓	
Dept. National Resources	1975-1978	• Evaluation & balanced development of mineral, water & energy resources having regard to future requirements • Administration of various water related legislation inc. River Murray Waters Act	✓	✓	
Dept. Minerals & Energy	1972-1975	• Evaluation & balanced development of mineral & energy resources for future requirements • Administration of a number of energy-related legislation inc. Snowy Mountains Hydro-electric Acts	✓	✓	
Dept. National Development & Energy	1980-1984	• National energy policy, inc. planning & research into coal, oil & gas, uranium, solar energy & other energy • Radioactive waste management • Minerals exploration & resource assessment • Water, soil conservation, & electricity	✓✓	✓✓	
Dept. Resources & Energy	1984-1988	• National resources & energy policy inc. planning, research, exploration, resource assessment, commercial development (minerals, fuels, & solar & energies) • Radioactive waste management • Water resources & electricity	✓✓	✓✓	

Dept. Primary Industries & Energy	1988-1998	• Agricultural, pastoral, fishing, forest, mineral & energy industries, & electricity • Water & other natural resources • Primary industries inspection & quarantine • Primary industries & energy science & research, inc. geoscience • Commodity marketing, inc. export promotion • Commodity-specific international organisations & activities • Administration of international commodity agreements, export controls on primary industries & energy products • Radioactive waste management • Administration of various energy-related, agriculture-related & water-related Acts inc.Murray Darling Basin Act 1983	✓✓	✓✓	✓✓
Dept. Agriculture, Fisheries & Forestry	1998-2007	• Agricultural, pastoral, fishing, food & forest industries • Water, soils & other natural resources • Rural adjustment & drought issues • Rural industries inspection & quarantine • Primary industries research inc. economic research • Commodity marketing, inc.export promotion & agribusiness • Commodity-specific international organisations & activities • Administration of international commodity agreements, export controls on agricultural. fisheries & forestry • Food policy, processing & exports		✓✓	✓✓
Dept. Environment, Water, Heritage & the Arts	2007-2013	• National fuel quality standards • Water policy & resources • (From 2008) Renewable energy programs • Energy efficiency • Greenhouse gas abatement programs • Community & household climate action	✓✓	✓✓	
Dept. Environment	2013-2015	• Environment protection & conservation of biodiversity, air quality, land contamination, urban environment, co-ordination of sustainable communities policy, population policy • National fuel quality standards • Development & co-ordination of domestic climate change policy, community & household climate action, climate change adaptation strategy & climate change science activities • Renewable energy, renewable energy target policy, regulation & co-ordination • Greenhouse emissions & energy consumption reporting, greenhouse gas abatement programmes • Water policy & resources *Water policy transferred to Department of Agriculture & Water resources (2015)* • Responsible for environmental water use & resources relating to the Commonwealth Environmental Water Holder	✓✓	✓✓	
Dept. Industry Dept. Industry & Science Dept. Industry, Innovation & Science	2013-2014 2014-2015 2015-Present	• Food processing industry policy • Energy policy • Mineral & energy industries, inc. oil,gas & electricity • National energy market • Energy-specific international organisations & activities • Minerals & energy resources research, science & technology • Radioactive waste management • Renewable energy technology development • Low emissions fossil fuel energy • Energy efficiency	✓✓		✓✓
Dept. Agriculture & Water Resources	2015-Present	• Agricultural, pastoral, fishing, food & forest industries • Soils & other natural resources • Rural adjustment & drought issues • Rural industries inspection & quarantine • Primary industries research inc. economic research		✓✓	✓✓

		• Commodity marketing, inc. export promotion & agribusiness • Commodity-specific international organisations & activities • Administration of international commodity agreements, export controls on agricultural, fisheries & forestry industries products • Food security policy & programmes • Water policy & resources • Biosecurity (animals & plants) • (2015) Environmental water use & resources relating to the Commonwealth Environmental Water Holder until transferred to Department of Environment		
Dept. the Environment & Energy	2016-Present	• Climate change adaptation strategy & co-ordination, community & household climate action, co-ordination of climate change science activities, co-ordination of sustainable communities policy, development & co-ordination of domestic climate change policy • Energy efficiency • Energy policy • Environment protection & conservation of biodiversity, environmental information & research, environmental water use & resources relating to the Commonwealth Environmental Water Holder • Greenhouse emissions & energy consumption reporting • Greenhouse gas abatement programmes • National energy market, including electricity & gas • National fuel quality standards • Renewable energy, renewable energy target policy, regulation & co-ordination, renewable energy technology development	✓✓	✓

Source: Australian Commonwealth Gazettes Administrative Arrangements (1901-Present)

Note: Years () indicate year of Gazette information was provided

The majority of the years served by a department with cross-sectoral responsibilities were served by those responsible for both energy and water. The only department to have cross-sectoral EWF responsibilities was the corresponding Department for Primary Industries and Energy. From 1988 to 1998, EWF matters were the responsibility of this single department indicating the full integration of EWF responsibilities. This Department operated during the Labor government until it was reorganised in 1998 under the Liberal government. The Department was responsible for administering a number of an energy-related, agriculture-related and water-related Acts including the Murray-Darling Basin Acts.

Non-government department organisations with cross-sectoral responsibilities were those that were responsible for cross-sectoral activities. For example, the Irrigation Production Advisory Committee established in 1938 with water and food responsibilities and the Snowy Mountains Hydro-Electric Power Authority established in 1949. After the 1970s, the number of EWF related organisations increased with a number of organisations created during the Hawke and Howard governments. Sector responsibilities were also fragmented between organisations indicating some potential overlaps in responsibilities. For example, both climate change departments and resource departments were both responsible for energy-related matters.

Other organisations with cross-sectoral responsibilities included newly established Murray Darling Basin bodies (Murray-Darling Basin Ministerial Council, Murray-Darling Basin Commission, Murray-Darling Basin Authority) and the Agriculture and Resource Management Council of Australia and New Zealand. Two important organisations were established including the Council of Australian Governments (COAG), which formalised intergovernmental relations in 1990, and the Australian Competition and Consumer Commission, which was given responsibilities across EWF industries regarding competition and pricing.

New South Wales

There were a number of government departments with cross-sectoral responsibilities. Table G2 lists all government departments with cross-sectoral responsibilities.

Table G2. NSW Government departments with multiple sector responsibilities

NEW SOUTH WALES	YEARS	EWF RESPONSIBILITIES	E	W	F
Dept. Mines	1874-1891	• Mining regulation • Minor agricultural responsibilities inc. sheep & cattle inspection & sheep directors	✓✓		✓✓
Dept. Mines & Agriculture	1891-1908	Mining & agriculture matters	✓✓		✓✓
Commissioner for Water Conservation & Irrigation	1912-1916	• River gauging, water conservation & irrigation schemes • Construction, maintenance & control of irrigation areas, water conservation works • Overseeing water conservation works constructed by the State, but administered by Local Trusts • Control of artesian & shallow boring • Licensing of private works for stock & domestic water supply, irrigation, & other purposes • Provision of businesses such as abattoirs, agricultural nurseries, & supply stores • Provision of public utilities such as domestic water supply, electricity supply, a sanitary dept., plus live stock for settlers • Authorising of granting leases including farming related leases • Controlling & managing Soldier Settlement on Irrigation areas		✓✓	✓✓
Dept. Works & Local Government	1936-1941	• Electricity supply • Water supply & sewerage, stormwater & swamp drainage	✓✓	✓✓	
Dept. Public Works	1901-1995	• Electricity supply • Water supply & sewerage, stormwater & swamp drainage, harbours & rivers administration	✓✓	✓✓	
Dept. Planning	1980-1995	• Management, development & conservation of natural & man-made resources including agricultural land, natural areas, forests, minerals, water	✓	✓	✓
Dept. Energy	1987-1988	• Rural Electricity Subsidy scheme • Promotion of electricity use (industrial & primary production purposes) • Advise electricity supply authorities on electricity tariffs, public lighting & standardising of materials & equipment	✓✓		✓
Dept. Water Resources	1987-1995	• Water policy • Farm & irrigation water (until transferred to Soil Conservation Service) • Planning, designing & constructing rural dams, weirs, irrigation channels		✓✓	✓

		• Operation & maintenance of major dams & water supply & drainage systems of irrigation areas • Administering & controlling use of the state's surface & ground water resources • Flood management • Improvement of aquatic environments • Developing a water-related land information system			
Dept. Minerals & Energy	1988-1991	• Management of state's mineral & energy resources • Advise government & community on energy & mineral matters, their co-ordination, development, utilisation & conservation • Promote responsible development, management & utilisation of the energy resources of NSW (ABS 1990) • Oversight planning of additional electricity supply capacity & of the supply & distribution of electricity, gas & petroleum products • Promote efficient & safe use of energy in business, transport & residential sectors • Administration of: Rural Electricity Subsidy scheme, State Energy Research & Development Fund, Electricity Development Fund	✓✓		✓
Ministry of Energy & Utilities	1999-2004	• Regulation of gas & electricity supply & distribution • Advice on policy, regulatory & operational issues for electricity, gas & metropolitan water utilities, emphasis on competitive national energy markets • Gas & electricity reform • Regulatory carriage of the greenhouse gas reduction requirements of electricity • Implementation of the National Electricity Market • Certification & implementation of national gas access regime • Support the license regulator in monitoring the compliance of the Sydney Water & Hunter Water corporations & the Sydney Catchment Authority • Major dams & weirs & regulators providing water for irrigation, town supplies & environmental flow • Country Towns Water Supply & Sewerage Program • Management guidelines for local water utilities • Greenhouse performance (administered Greenhouse Gas Emissions Reduction Act 2002), Solar energy research • Role in the Energy & Utility Services Function Area of the State Emergency Management Committee in preparing sub-plan to support & restoration of electricity, water, sewerage, gas & petroleum in critical situations • Electricity & gas network safety & reliability • Energy assistance & concession schemes	✓✓	✓✓	
Dept. Infrastructure, Planning & Natural Resources Dept. Natural Resources	2003-2005 2005-2007	• *Some water functions but not well defined* • Integrated advice to govt. on decisions affecting land use & natural resource management • Development of regulatory environment for land use & planning & framework for development control • Decision about natural resource allocation & establishment of regulatory environment for natural resource decisions • Natural Resource Management & Allocation - managing access to natural resources, such as water, through regulation, licensing & pricing • Regulation & Compliance • Research, Advice & Education on natural resource conservation including energy conservation • Electricity Demand Management Project *(transferred to the Dept. of Energy, Utilities & Sustainability in 2005)*	✓	✓	
Dept. Energy, Utilities & Sustainability Dept. Water & Energy	2004-2007 2007-2009	• Legislation for regulating electricity & gas supply & reticulation, electricity safety, water management, related to county councils, power stations & water supply bodies • Electricity & gas network safety & reliability • Administering electricity contestable works accreditation scheme • Country towns water supply & sewerage programs	✓✓	✓✓	

		• Support for drought affected communities • Management guidelines for local water utilities • Greenhouse performance • Solar research • Energy assistance & concession schemes • *(2007) Dept. of Water & Energy incorporated both energy & water functions of the Dept. of Energy, Utilities & Sustainability & the Metropolitan Water Directorate (of the NSW Cabinet Office)*			
Dept. Primary Industries	2004-2009	• Profitable & sustainable primary industries • Assist primary industries in natural resource management • Safe working environment with respect to human, mine & biosecurity safety	✓		✓✓
Dept. Environment & Climate Change Dept. Environment, Climate Change & Water	2003-2009 2009-2011	• Environment Protection & Regulation Divisions • Policy & Science Division – inc. environmental policy (water) • Climate change/energy-related responsibilities	✓	✓	
Dept. Industry & Investment Dept. Trade & Investment, Regional Infrastructure & Services Dept. Industry, Skills & Regional Development Dept. Industry	2009-2011 2011-2015 2015-2017 2017-Present	Responsible to portfolios: Energy, Mineral Resources, Primary Industries, Regional Development, Rural Affairs, Oversight over former Dept. of Industries, Dept. of Water & Energy, Office of the Rural Assistance Authority, Office of the NSW Food Authority	✓	✓	✓
Dept. Planning & Environment (Resources & Energy)	2017-Present	• Energy policy & planning • Mining which in NSW involved integrated mining policies that account for agricultural impacts	✓		✓
Dept. Primary Industries	2017-Present	• Agriculture and fisheries • Biosecurity & food safety			✓✓

Source: NSW State Archives & Records website 2018, ABS Australia Year Book from 1908-2012

The majority of the years served by a department with cross-sectoral responsibilities were served by those responsible for both energy and water. Aside from government departments, the Commissioner for Water Conservation and Irrigation (1912-1916), and the Water Conservation, and Irrigation Commission (1939-1969) had responsibilities related to both water and food, largely given its responsibilities for irrigation in the state.

The number of departments with cross-sectoral responsibilities rose during the fifth period. Such departments were not specific to EWF and included departments with a broader scope of responsibilities. These departments included Department of Planning (1980s), Department of Industry and Investment followed by the Department of Trade and Investment (2009-2014) and the Department of Industry, Skills and Regional Development. All departments reflected industry and planning themes. Departments were likely to be responsible to multiple ministers (those responsible for industry, investment and trade areas). Departments did not correspond to the relevant EWF ministers. Other cross-sectoral organisations included a number of departments mostly with energy and water responsibilities and one departments with water and food responsibilities. For example, the Independent Pricing Regulatory Tribunal was responsible for energy and water pricing.

Current departments have separate responsibilities, the Departments of Planning and Environment is responsible for energy matters, the Departments of Primary Industries is responsible for food while the Departments of Industry is responsible for water through the Departments of Industry.

Victoria

Unlike the number of ministers, fewer government departments had cross-sectoral responsibilities. Table G3 lists all government departments with cross-sectoral responsibilities.

Table G3. Victorian Government departments with multiple sector responsibilities

VICTORIA	YEARS	EWF RESPONSIBILITIES	E	W	F
Dept. Mines	1860-1895 1909-1977	• Supervision & regulation of mining activities (issue of miners rights, business & residence licences, mining leases, mineral & other prospecting licences) • Investigation of the state's geological structure, mineral wealth & underground water resources development of the mining industry • Regulation of waste & sludge disposal • Administration of Victorian Mining Accident Relief Fund • Water supply on the goldfields, Rural water supply • Victorian Water Supply Dept. responsible for waterworks, land purchase, levy charges, lease & sale of works, loans to local water trusts (part of Dept. of Mines from 1865 to 1889, 1895 to 1905) • (1909-1977) Provision of technical services & financial assistance • Issue of Petroleum Prospecting Licenses, Petroleum Mineral Leases & Petroleum Exploration Permits • Regulation of pipelines, onshore & offshore petroleum installations & for the transportation & storage of inflammable liquids & liquefied gases	✓✓	✓✓	
Dept. Mines & Water Supply	1895-1909	• Management of rural water supply, inc.provision of water for mining, manufacturing & industrial uses, domestic & stock supply & irrigation • Supervision, regulation & licensing mining activity • Investigating state's geological structure, mineral wealth & underground water resources • Mining industry development • Supervising safe working of mines, machinery & quarries • Regulation of waste & sludge disposal	✓✓	✓✓	
Dept. Minerals & Energy	1977-1985	• Development & use of minerals & energy resources, inc. brown coal, natural gas, oil, hydro-electricity & solar energy. Planning for possible introduction of nuclear energy • Co-ordination of large fuel & power statutory authorities (State Electricity Commission, Gas & Fuel Corporation & the Victorian Pipelines Commission, & oil & gas companies) • Regulation of mining, extractive, fuel & power industries • Technical & scientific advisory services • Geological Survey of geological structure, mineral wealth & underground water resources • Regulation of groundwater use & dumping of toxic waste • Licensing of mining & extractive activity & supervision of safe working of mines, quarries, pipelines, on- & off-shore oil & petroleum installations, & related equipment	✓✓	✓✓	
Dept. Water Resources	1984-1990	• Policy development, planning & coordination of water industry for provision of water services • Management of water resources & provision of water services		✓✓	

		• Development of a comprehensive database for water resources & water-related matters • Management, technical support, dissemination of information • Public education programs to promote community awareness of the need for more efficient & effective management of the state's water resources			
Dept. Industry, Technology & Resources	1985-1990	• Development & use of minerals & energy resources, inc. brown coal, natural gas, oil, hydro-electricity & solar energy • Co-ordination of large fuel & power statutory authorities (State Electricity Commission, Gas & Fuel Corporation & the Coal Corporation of Victoria, & oil & gas companies) • Regulation of mining, extractive, fuel & power industries • Technical & scientific advisory services • State's geological survey to investigate geological structure, mineral wealth & underground water resources, • Regulation of groundwater resources & dumping of toxic waste • Licenses of mining & extractive activity & supervision of safe working of mines, quarries, pipelines, on & off-shore oil & petroleum installations, & related equipment	✓✓	✓✓	
Dept. Conservation & Natural Resources	1992-1996	• Water resources management & rural water resources policy • Environment protection policy & planning • Co-ordination of Govt.'s response to the Greenhouse Effect & Greenhouse monitoring, • Developing state-wide land-use controls & regional environment plans • Advising government agencies, industry & the community on environmental matters as well as the provision of facilities for marine & environmental research • Commercial fishing licenses	✓	✓✓	✓
Dept. Agriculture, Energy & Minerals	1995-1996	*Assumed all responsibilities of the Dept. of Energy & Minerals & the Dept. of Agriculture* • Agriculture Victoria - Agriculture-related functions: provision of guidelines & standards relating to agriculture veterinary services; animal welfare; quarantine & animal & plant inspection; development of sustainable agriculture; & development of policies relating to agriculture & rural affairs • Energy & Minerals Victoria - Development of energy & minerals markets through exploration, administration & regulation. Energy Policy Division: development of policies for the restructuring & privatisation of public sector utilities • Resources Development Division - Regulation & development of state's mineral, petroleum & other earth resources. Administration of Mineral Resources Development Act 1990	✓✓		✓✓
Dept. Natural Resources & the Environment	1996-2002	*Assumed responsibility of the Dept. of Agriculture, Energy & Minerals, & the Dept. of Conservation & Natural Resources* • Catchment Management & Sustainable Agriculture - policies & programs for sustainable development, protection of state's land & water resources & the control of pest plants & animals • Minerals & Petroleum - exploration & development of the state's mineral, petroleum & other earth resources • Primary Industries - veterinary & animal welfare services, fisheries, & agriculture • Water - provision & maintenance of water within the state, inc. water supply & sewerage services & associated infrastructure	✓✓	✓✓	✓✓
Dept. Primary Industries	2002-2013	*Assumed primary production responsibilities of the Dept. of Natural Resources & the Environment* • Farming & agriculture, Fishing & aquaculture • Minerals & petroleum • Science & research, trade & investment.	✓✓		✓✓

		DPI reported to the Minister for Agriculture & the Minister for Energy & Resources			
Dept. Environment & Primary Industries	2013-2014	• Sustainable management of water resources, climate change, bushfires, public land, forests & ecosystems. *Formed by bringing together functions from the former Dept. of Sustainability & Environment & the former Dept. of Primary Industries* • Land & water management together with primary industries help boost productivity of Victoria's food & fibre sector. Reorganised vital role of land managers & Landcare groups in the protection of the environment & management of natural resources. • Natural resources & environment • Capital projects • Water, Desalination • Agriculture, Fisheries & game • Regulation & compliance, business services		✓✓	✓✓
Dept. Economic Development, Jobs, Transport & Resources	2015-2017	• Energy & resources responsibilities *Agriculture portfolio from the former Dept. of Environment & Primary Resources*	✓✓		✓✓
Dept. Environment, Land, Water & Planning	2014-2017 2017-Present	*Water portfolio overseeing the state wide network of authorities to deliver water to cities & towns, & for irrigation, wastewater management, & maintaining healthy rivers & a resilient water supply system*		✓✓	

Source: Public Record Office Victoria website 2018, ABS Australia Year Books from 1908-2012

The majority of the years served by a department with cross-sectoral responsibilities were served by those responsible for both energy and water, in particular, the mining department responsible for both mining and groundwater matters. Other departments included the Department of Industry, Technology and Resources (1985-1990) although mainly responsible for energy, the Department. also was responsible for water through the surveying of underground water resources. The Department of Agriculture, Energy and Minerals, the Department of Primary Industries and the Department of Economic Development, Jobs, Transport and Resources all had energy and food responsibilities.

The Department of Conservation and Natural Resources (1992-1996) had responsibilities mostly related to water and food and the Department of Natural Resources and the Environment (1996 to the end of the period) had responsibilities across EWF sectors, responsible for catchment management and sustainable agriculture, land management, minerals and petroleum, primary industries and water resources, water supply and sewerage services and infrastructure.

Queensland

There were only a couple of organisations with cross-sectoral responsibilities. Table G4 lists all government departments with cross-sectoral responsibilities.

Table G4. Queensland Government departments with multiple sector responsibilities

QUEENSLAND	YEARS	RESPONSIBILITIES	E	W	F
Lands Dept. (Irrigation & Water Supply Sub-Dept.)	1932-1947	• Water supply conservation, water resources, irrigation		✓	✓

Dept. of Natural Resources	1996-2001	• Management of land including titles • Administration of water related legislation; the Metropolitan Water Supply & Sewerage Act 1909, Murray-Darling Basin Act 1996, New South Wales-Queensland Border Rivers Act 1946, Sewerage & Water Supply Act 1949 (except as administered by the Minister for Communication & Information & Minister for Local Government, Planning , Regional & Rural Communities), Rural Lands Protection Act & Soil Acts		✓✓	✓
Dept. of Natural Resources & Mines	2001-2004	• Natural resources & mining, mineral resources • Aboriginal & Torres Strait Islander matters • Commercial water services • Catchment and water resource management	✓✓	✓✓	
Dept. of Natural Resources, Mines & Energy	2004-2004 2017-Present	• Managing natural resources, mining & energy • Access to Natural Gas Pipelines, Distribution & Retail of Reticulated Fuel Gas, & Sufficiency of Supply of Fuel Gas & Liquid Fuel • Electricity	✓✓	✓✓	
Dept. of Natural Resources & Mines	2004-2006 2012-2017	• Management of natural resources & mining	✓✓		
Dept. of Natural Resources, Mines & Water	2006-2006	• Management of natural resources, mining, & water infrastructure	✓✓	✓	
Dept. of Natural Resources & Water	2006-2009	• Land interests including titles, surveying & mapping, native title, forestry management, & water • Natural Resource Management (of relevance) • Catchment Management and Water Resource Management excluding - Land Conservation • Petroleum Titles, Pipeline Licences • Quarry Sales under the Forestry Act 1959 • Selling allocation of state quarry material under the Water Act 2000 • Natural Resource Recreation & Education • Water Recycling Strategy • Climate change science & policy	✓✓	✓✓	
Dept. of Employment, Economic Development & Innovation	2009-2012	*Responsible to the Minister for Natural Resources, Mines & Energy, Minister for Energy & Water Utilities, Minister for Primary Industries, Fisheries & Rural & Regional Queensland* • Mines, minerals, mineral resources impacts on minerals, on Aboriginal & Torres Strait Islander interests • Energy, electricity • Access to Natural Gas Pipelines, Pipeline Licences • Distribution & Retail of Reticulated Fuel Gas, & Sufficiency of Supply of Fuel Gas & Liquid Fuel • Explosives • Gas Safety & Health • Geological Survey, Geothermal Energy, Geothermal Safety & Health, Geothermal Title • Mining Safety & Health, Mining Titles • Native Title (relating to mining, petroleum & geothermal) • Petroleum Safety & Health, Petroleum Titles • Royalties • *Energy & Water Utilities (From February 2011)* • Clean Energy, Electricity & Gas Sectors & Markets Regulation, Monitoring & Consumer Protection • Energy Efficiency, Energy Industry Development • Geothermal Energy, Nuclear Energy Policy, Renewable Energy • Bulk Water supply, distribution & retail arrangements • Primary Industries, Fisheries & Rural & Regional Queensland portfolio • Agricultural Chemicals, Agricultural Colleges • Biosecurity • Fisheries Resource Management (from 21 Feb 2011 - Fisheries) • Food & Fibre Production, Food Processing & Value Adding Development	✓✓	✓✓	✓✓

		• Animal Welfare, Plant & Animal Diseases • Primary Industry Research, Development & Extension • Regional & Rural Communities • Regional Economic Development (from 21 Feb 2011)		
Dept. of Energy & Water Supply	2012-2017	Energy & water utilities Clean energy Electricity & gas sectors & markets regulation, monitoring & consumer protection Energy efficiency, conservation & demand management Energy industry development, Nuclear energy policy Renewable energy Reticulated fuel gas distribution & retail, Sufficiency of supply of fuel gas & liquid fuel Bulk water supply, distribution & retail arrangements. *Management of water supply emergencies (from 1 July 2013)* *Protection of public health & safety in provision of water & sewerage services (from 1 July 2013)* *Safe operation & management of referable dams (from 1 July 2013)* *Water recycling strategy (from 1 July 2013)* *Water supply policy, planning & regulation (from 1 July 2013)*	✓✓	✓✓
Dept. of Natural Resources & Mines	2012-2017	• Matters relating to mining & petroleum, natural resource management & Aboriginal & Torres Strait Islander land interests • Mining & petroleum industry development; Mining, petroleum & geothermal tenures • Extractive resource planning • Gas pipelines, Pipeline licenses • Geological survey, exploration promotion & investment attraction • Greenhouse gas storage • Land access policy • Rents • Safety & health including: abandoned mines, explosives, extractive industries, gas, geothermal, mining & petroleum • Aboriginal & Torres Strait Islander matters inc.: Land interests; Land titles, mineral resource impacts • Governance & oversight of select water authorities • Allocation, management & use of state land • Compulsory acquisition • Conservation, information • Land protection (removed 1 July 2013) • Land titles, Native title, Place names • Surveying & mapping, valuations • Natural resource management, Catchment management, water resource management • Selling allocation of state quarry material under Water Act 2000 • Registration of valuers & surveyors *Water resource allocation, planning & management (from 1 July 2013)* *Western rivers (from 1 July 2013)*	✓✓	✓✓
Dept. of Natural Resources, Mines & Energy	2017-2018	• Mining & Petroleum: • Extractive Resource Planning • Gas Pipelines, Pipeline Licences • Geological Survey • Exploration Promotion & Investment Attraction • Greenhouse Gas Storage • Land Access Policy • Mineral & Energy Resources • Mineral Resources Impacts on Aboriginal & Torres Strait Islander Interests • Mining & Petroleum Industry Development, Mining, Petroleum & Geothermal Tenures • Rents *Takes over responsibilities of the previous Dept. of Energy & Water*	✓✓	✓✓

Source: Queensland State Archives website 2018, ABS Australia Year Book from 1908-2012

The majority of the years served by a department with cross-sectoral responsibilities were served by those responsible for both water and food. The two organisations included the Lands Dept. responsible for (irrigation and water supply and the Irrigation and Water Supply Commission both with water and food responsibilities. These organisations were responsible for inter-sectoral activity, i.e. irrigation. Aside from the irrigation reflecting both water and food linkages, EWF responsibilities were largely separated across different organisations.

Instances of cross-sectoral departments were evident from the late 1990s. In 2009, under the Bligh Labor government, was the only instance of full EWF integration was seen in the Department of Employment, Economic Development and Innovation. Other departments were responsible for energy and water including the Department of Natural Resources and Mines (2001-2009), Department of Energy and Water Supply (2012-2016), Department of Natural Resources and Mines (2012-2016), Department of Energy and Water Supply (2012-2016), Department of Natural Resources and Mines (2012-2016) and more currently the Department of Natural Resources, Mines and Energy (2017-Present).

South Australia

In the early periods, EWF were responsibilities of separate organisations which were all government departments including the Department of the Engineer in Chief and Hydraulic Engineer and its predecessors the Waterworks Commission, Commissioner of Public Works from 1856, the Department of Agriculture followed by the Central Bureau of Agriculture and the Department of Mines. There were few of organisations with cross-sectoral responsibilities. Table G5 lists all government departments with cross-sectoral responsibilities.

Table G5. South Australian government departments with multiple sector responsibilities

SOUTH AUSTRALIA	YEARS	EWF RESPONSIBILITIES	E	W	F
Dept. Agriculture	1908-1975	• Agricultural matters • Farm Water Schemes, Department of Agriculture provides advisory service on water conservation & irrigation designs on farms, & on the suitability of underground water for irrigation & stock purposes		✓	✓✓
Engineering and Water Supply Dept.	1931-1992	• Water and irrigation responsibilities		✓✓	✓
Dept. Primary Industries & Resources (PIRSA I)	1997-2011	• Agriculture & fisheries (primary industries) & minerals, energy & petroleum (resources) • Administration of Mining Legislation	✓✓	✓	✓✓
Dept. Primary Industries & Regions SA (PIRSA II)	2011-2018 Present	*Responsibility of the Minister for Primary Industries, Natural Resources & Regional Development & the Chief Executive, Primary Industries & Resources South Australia* *(2010) Biosecurity functions of the Dept. of Water, Land, Biodiversity Conservation transferred to the Dept. of Primary Industries & Resources forming Biosecurity SA* • Rural chemicals, Land use planning • Environmental management systems • Murray Darling Basin Commission & Water policy, Marine habitat • Rural Communities & drought policy			

		• Genetically Modified Organisms (GMO's), food safety & organic farming			
Minerals & Energy Resources Division (Division of Primary Industries & Resources)	1997-2012	• Geophysical survey • Supporting exploration activity & issuing relevant licences, identifying new prospective terrains • Regulating mining & petroleum activity • Ensuring environmental standards maintained throughout exploration & mining operations • Encouraging indigenous people & their support for mineral & petroleum activities • Encouraging resource processing & ensuring adequate infrastructure is in place; & investigating & encouraging responsible management of groundwater supplies	✓✓	✓	
Dept. State Development	2014-2018	• Main function of providing direction the state's economic transformation • Mineral Resources & Energy (Resources & Energy Group including the Mineral Resources Division, Energy Resources Division, Energy Markets & Programs Division, Office of the Technical Regulator, Renewables SA) • Water Industry Technical & Safety Regulations (Office of the Technical Regulator)	✓	✓	

Source: State Records of South Australia website 2018, ABS Australia Year Book from 1908-2012

The majority of the years served by a department with cross-sectoral responsibilities were served by those responsible for both water and food. There were limited instances of cross-sectoral departments which corresponded to mixed portfolios. Departments with cross-sectoral responsibilities included the Department of Agriculture (1908-1975) with both water and food responsibilities. The department was responsible for agricultural matters along with water matters related to Farm Water Schemes, the provision of an advisory service on water conservation, irrigation designs on farms, suitability of underground water for irrigation and stock purposes. The Department of Primary Industries and Resources (1997-1999) had EWF responsibilities associated with agriculture and fisheries (primary industries), water policy, minerals, energy and petroleum (resources) and the administration of mining legislation, under the responsibility of the Minister for Primary Industries, Natural Resources and Regional Development. The Department of State Development was responsible for energy and water from 2014 to 2018. Current government departments reflect the separation of EWF, and other organisations appear sector specific.

Tasmania

In Tasmania, various organisations including government departments as well as ministerial offices and other statutory boards. Table G6 lists all government departments with cross-sectoral responsibilities.

Table G6. Tasmanian Government departments with multiple sector responsibilities

TASMANIA	YEARS	EWF RESPONSIBILITIES	E	W	F
Hydro-Electric Dept.	1914-1929	• Hydro-electrical developments providing for electricity requirements	✓✓	✓✓	
Hydro-Electric Commission	1929-1995	• Mines Dept. power to grant certain rights for mining operations. Hydro-Electric Commission responsible for			

		approvals of the abstraction of water from any stream or lake of potential value for power generation			
Dept. Resources & Energy	1989-1992	• Administration of mineral resources & perform scientific research relating to the earth sciences & mineral resources • Encourage mineral development Formed by the amalgamation of the Rivers & Water Supply Commission, the Dept. of Mines & Hydro-Electric Commission	✓✓		
Dept. Primary Industry, Fisheries & Energy Dept. Primary Industry & Fisheries	1992-1993 1993-1998	• Provision of expert advice, reports & policy recommendations to Government • Development, review & administration of legislation relating to plant & animal health & quality standards • Implement government policy relating to living marine resources. • Management, control, regulation & protection of sea fisheries, salmon fisheries & fisheries inland waters • Scientific research, market research & consumer education • Provision extension services, economic information & marketing advisory services & veterinary practitioners • Licensing & control commercial fish farms, eel fishing, whitebait fishing, & importation of fish into Tasmania • Assessment of groundwater resources • Establishment & maintenance of water supply, irrigation, drainage & river improvement schemes • Licensing & inspection of the taking of water from streams & lakes & construction of farm dams • Assistance & advise for drainage trusts • Examination of proposed municipal water, sewerage & drainage works • Measurement stream flows & flood levels • Provision of statistics & investigate the availability of water for future use • Implementation of the fluoridation of water supplies • Oversee bulk supply of water to cities & municipalities in the Hobart region	✓✓	✓✓	✓✓
Dept. Primary Industries, Water & Environment Dept. Primary Industries & Water	1998-2006 2006-2009	• Protection of the environment of the state, management of the Crown Estate & the state's National Parks, Reserves & wildlife resources • Maintenance of survey records & provision search facilities, conducted scientific studies, planned land use; advise on land use policy, preserved & protected sites of significance to the Aboriginal & European heritage of Tasmania; • Administration of legislation relating to plant & animal health & quality standards • Management of the state's resources, air, land, water, plants & animals		✓✓	✓✓
Dept. Primary Industries, Parks, Water & Environment	2009-Present	• Provision of a diverse range of services that support primary industry development, the protection of the natural environment, effective land & water management & the protection of the State's relative disease & pest free status • Maintain the security of land tenure • Administration state's Crown lands & delivery of government services through Service Tasmania		✓✓	✓✓

Source: Tasmanian Archives website 2018, ABS Australia Year Book from 1908-2012

During the first three periods, the only organisation to have cross-sectoral responsibilities were Hydro-Electricity related organisations such as the Hydro-Electric Department followed by the Hydro-Electric Commission. In the late 1980s, the Department of Resources and Energy (1989-1992) had both energy and water responsibilities (formed by the amalgamation of the Rivers and Water Supply Commission and the Dept. of Mines and Hydro-Electric Commission). In the early 1990s, the Department of Primary Industry, Fisheries and Energy (1992) followed by the

Department of Primary Industry and Fisheries had EWF responsibilities (administering a number relevant legislation in each sector), indicating full integration. In 1998, responsibilities were separated. Water and food matters of the Department of Primary Industries, Water and Environment and energy was transferred to the Dept. of Infrastructure, Energy and Resources. In 1996, the Office of Energy Planning and Conservation was transferred to the Department of Transport. Currently, the Department of Primary Industries, Parks, Water and Environment has water and food responsibilities.

Western Australia

Despite the limited cross-sectoral responsibility evident at the portfolio level and the ministerial level, cross-sectoral responsibility was seen in the responsibilities of the Public Works Department from the beginning of the period until 1986, responsible for water and indirectly food through responsibilities over agricultural water. Responsibilities included control of the water supply for Goldfields and Agricultural Areas, irrigation and maintenance of tanks & wells. EWF responsibilities were otherwise separated at the organisational level. No government department had responsibilities covering EWF. The majority of the years served by a department with cross-sectoral responsibilities were served by those responsible for both water and food.

Northern Territory

Table G7 list all government departments with cross-sectoral responsibilities.

Table G7. Northern Territory Government departments with multiple sector responsibilities

NORTHERN TERRITORY	YEARS	RESPONSIBILITIES	E	W	F
Dept. Primary Industry, Fisheries & Mines	2005-2009	• Primary Production (including Pastoral, Agricultural & Horticultural Industries) • Fisheries Development & Research Aquaculture Development • International Agricultural Quarantine Interstate Agricultural Quarantine • Mining Development, Mining Titles Administration • Northern Territory Geological Survey • Mining Occupational Health & Safety Environmental Management of Mining Operations • Petroleum Industry Development, Petroleum Titles Administration • Petroleum Occupational Health & Safety • Environmental Management of Petroleum Operations • Administration of Petroleum Industry Operations (Onshore & Offshore) • Energy Policy, Planning & Development	✓✓		✓✓
Dept. Health	2007-2015	• Food standards & water standards		✓	✓
Dept. Regional Development, Primary Industry & Resources	2009-2010	• Primary Production (including Pastoral, Agricultural & Horticultural Industries) • Interstate Agricultural Quarantine, Biosecurity • Primary Industries, Fisheries Management & Research Aquaculture Development • Mining Development, Mining Titles Administration	✓✓		✓✓

		• Northern Territory Geological Survey Mining Occupational Health & Safety • Environmental Management of Mining Operations, Petroleum Industry Development, Petroleum Operations • Petroleum Titles Administration, Petroleum Occupational Health & Safety • Administration of Petroleum Industry Operations (Onshore & Offshore) • Energy Policy, Planning & Development			
Dept. Resources	2010-2015	• Primary Production (including Pastoral, Agricultural & Horticultural Industries) • Interstate Agricultural Quarantine, Biosecurity • Primary Industries • Fisheries Management & Research • Aquaculture development • Mining & Geothermal Energy Development • Mining Titles Administration • Northern Territory Geological Survey • Mining Occupational Health & Safety • Environmental Management of Mining Operations, Petroleum Operations, Petroleum Industry Development • Petroleum Titles Administration • Petroleum Occupational Health & Safety • Environmental Management • Administration of Petroleum Industry Operations (Onshore & Offshore) • Energy Management & Operations	✓✓		✓✓
Dept. Primary Industry & Resources	2016-2016 2017-Present	• Energy policy, Energy industry development, Energy (oil & gas) pipeline operation regulation, pipeline title administration, Energy (oil, gas & geothermal) titles administration, Energy operations regulation • Environmental management of energy (oil, gas & geothermal) operations, Environmental management of mining operations • Fisheries management • Hygienic production of meat for human consumption • Interstate agricultural quarantine • Mining development, Mining titles administration, Northern Territory Geological Survey • Oil & gas strategy, policy & industry development • Petroleum industry development, Petroleum titles administration • Primary industry biosecurity, Primary production & industry development, Animal welfare • Regulation & management of mining & energy operations	✓✓		✓✓

Source: Northern Territory Archives Service website 2018, Northern Territory Gazettes Administrative Arrangements, ABS Australia Year Book from 1908-2012

As seen, most cross-sectoral responsibilities included those combining energy and food. The current government department, Department of Primary Industries and Resources indicated integration between energy and food. During the period, despite separate portfolios, integration was evident in the allocation of multiple portfolios to individual ministers.

Australian Capital Territory

Table G8 lists all government departments with cross-sectoral responsibilities.

Table G8. ACT Government department with multiple sector responsibilities

AUSTRALIAN CAPITAL TERRITORY	YEARS	RESPONSIBILITIES	E	W	F

Dept. Treasury	2001-2004	• Energy & Water policy (economic)	✓✓	✓✓	
Dept. Urban Services	2001-2004	• Water policy • Electricity & natural gas industry technical regulation	✓✓	✓✓	
Planning & Land Authority	2004-2010	• Electricity & natural gas, water & sewerage industry technical regulation	✓✓	✓✓	
Dept. Territory & Municipal Services	2006-2008	• Environment management & regulatory services • Sustainability & climate change • Energy & water policy	✓✓	✓✓	
Dept. Environment Climate Change, Energy & Water	2009-2010	• Climate change policy • Environmental sustainability policy, Environment protection • Water policy, Water efficiency programs	✓✓	✓✓	
Environment & Sustainable Development Directorate	2010-2013	• ACTPLA Climate change policy • Electricity & natural gas, water & sewerage industry technical regulation, Energy policy & energy efficiency programs Environmental sustainability policy • Environment protection • Strategic land use & transport planning • Water policy & water efficiency programs	✓✓	✓✓	
Environment & Planning Directorate	2013-2016	• Climate change policy • Energy policy & energy efficiency programs, Electricity & natural gas, • Environment protection policy • Water policy & water efficiency programs, water & sewerage industry technical regulation	✓✓	✓✓	
Environment, Planning & Sustainable Development Directorate	2016-Present	• Water policy & water efficiency programs • Climate change policy • Energy policy & energy efficiency programs	✓✓	✓✓	
Economic Development Directorate	2018-2018	• Agricultural & environmental sciences • Food safety licence sing & regulation • Renewable energy industry development strategy, Electricity & natural gas, water & sewerage industry technical regulation • Environment protection & water regulation	✓✓	✓✓	✓✓

Source: Australian Capital Territory Gazettes Administrative Arrangements, ABS Australia Year Book from 1908-2012. Information not available prior to 2000.

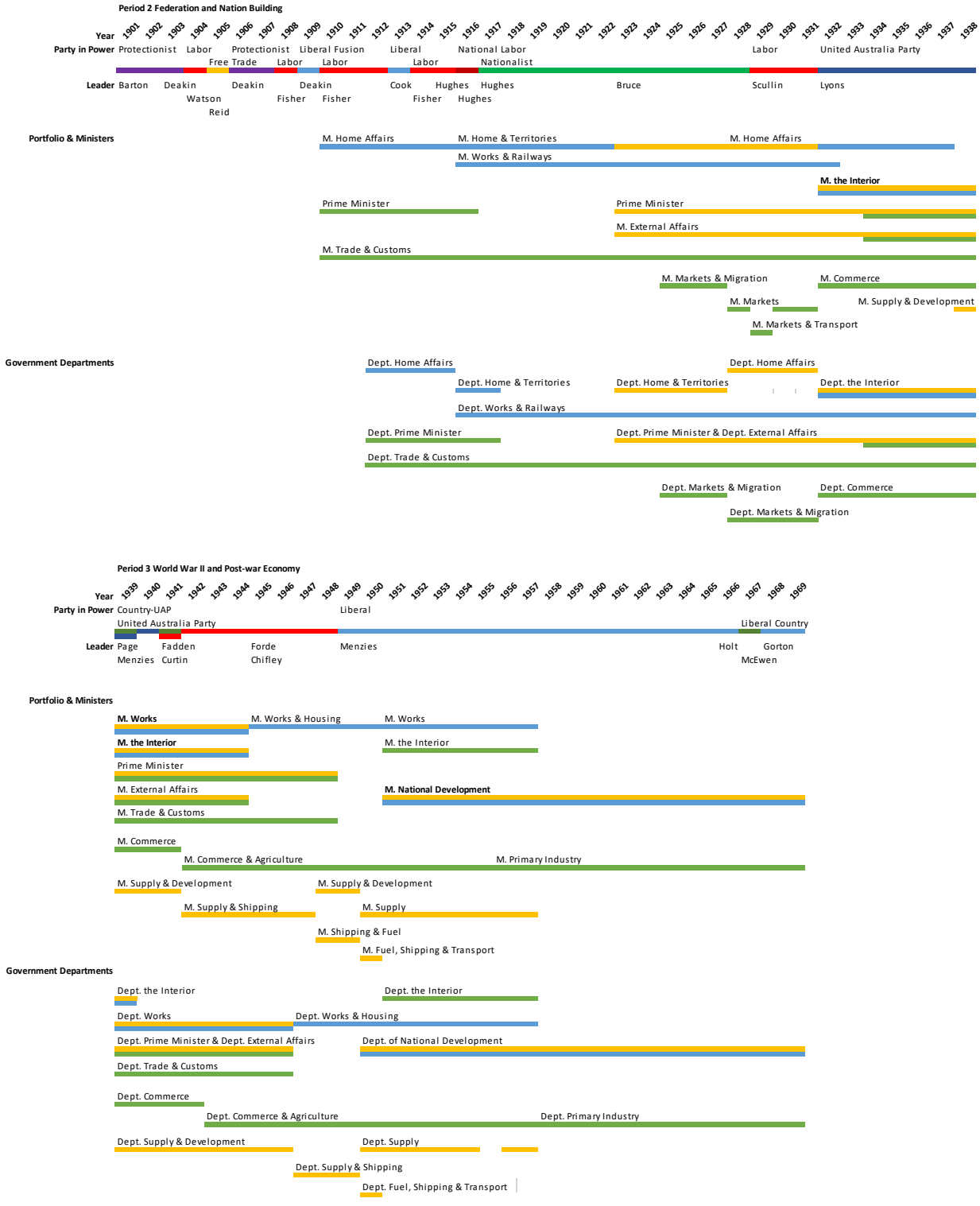
As seen, most cross-sectoral departments included those combining energy and water. Food is the responsibility of the state's department for health, ACT Health, responsible for food safety and standards.

Appendix H. Timeline of ministers and government departments

The timelines below map for each jurisdiction since self-government to the present, energy, water and food-related portfolios, the ministerial positions held, government departments in operation, and the leaders and political parties in power. The coloured ribbons under ministerial positions indicate responsibilities held (yellow - energy responsibilities, blue – water responsibilities and green – food responsibilities). Multiple ribbons indicate responsibility of multiple sectors. Ministerial positions in **bold** indicate combined or multiple-sector portfolios. Coloured ribbons are also used to indicate changes in political parties.

Each timeline has been developed from historical information provided from parliamentary websites and state archives records. A list of data sources are provided in Appendix D.

Figure H1. Commonwealth



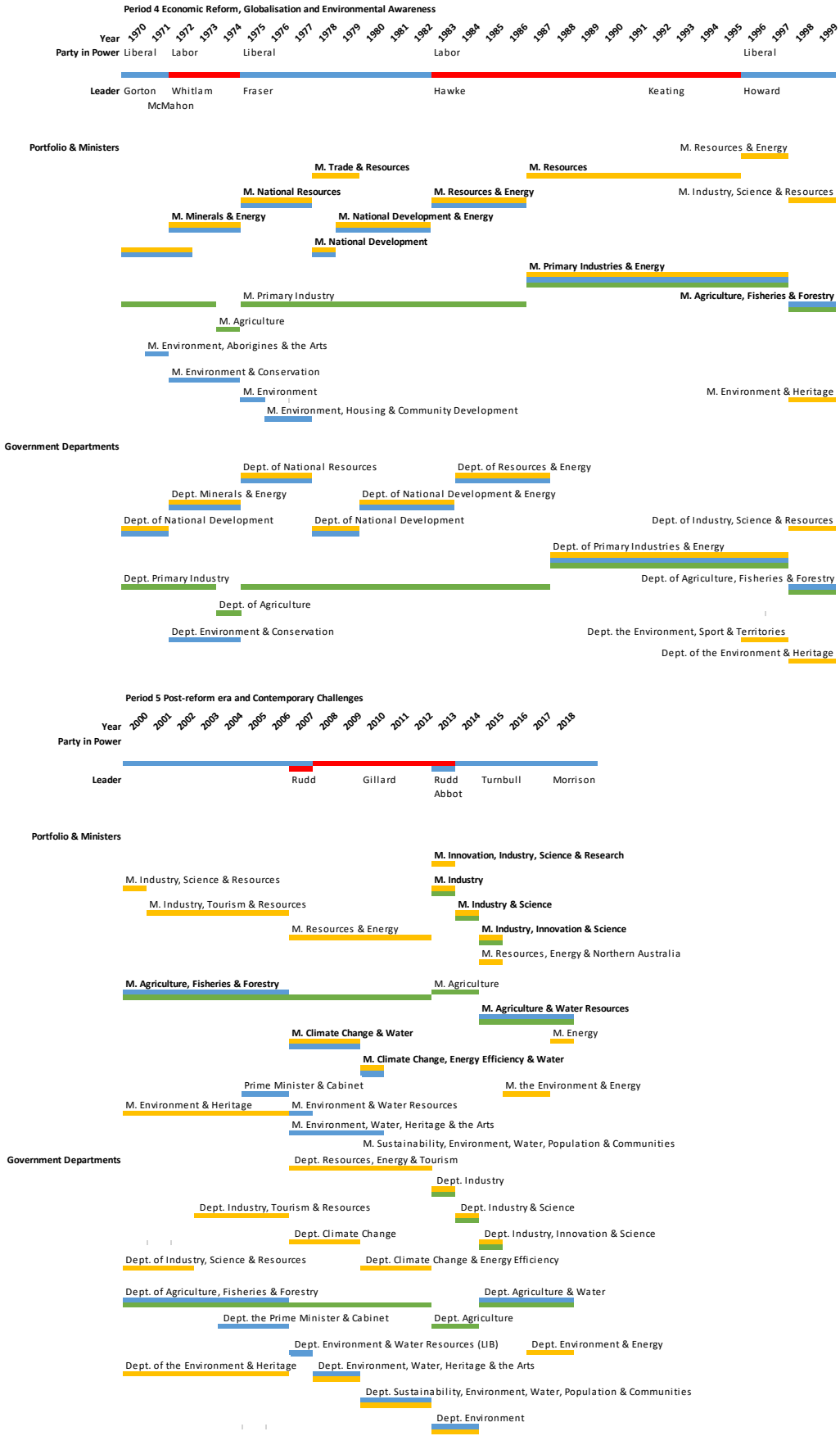
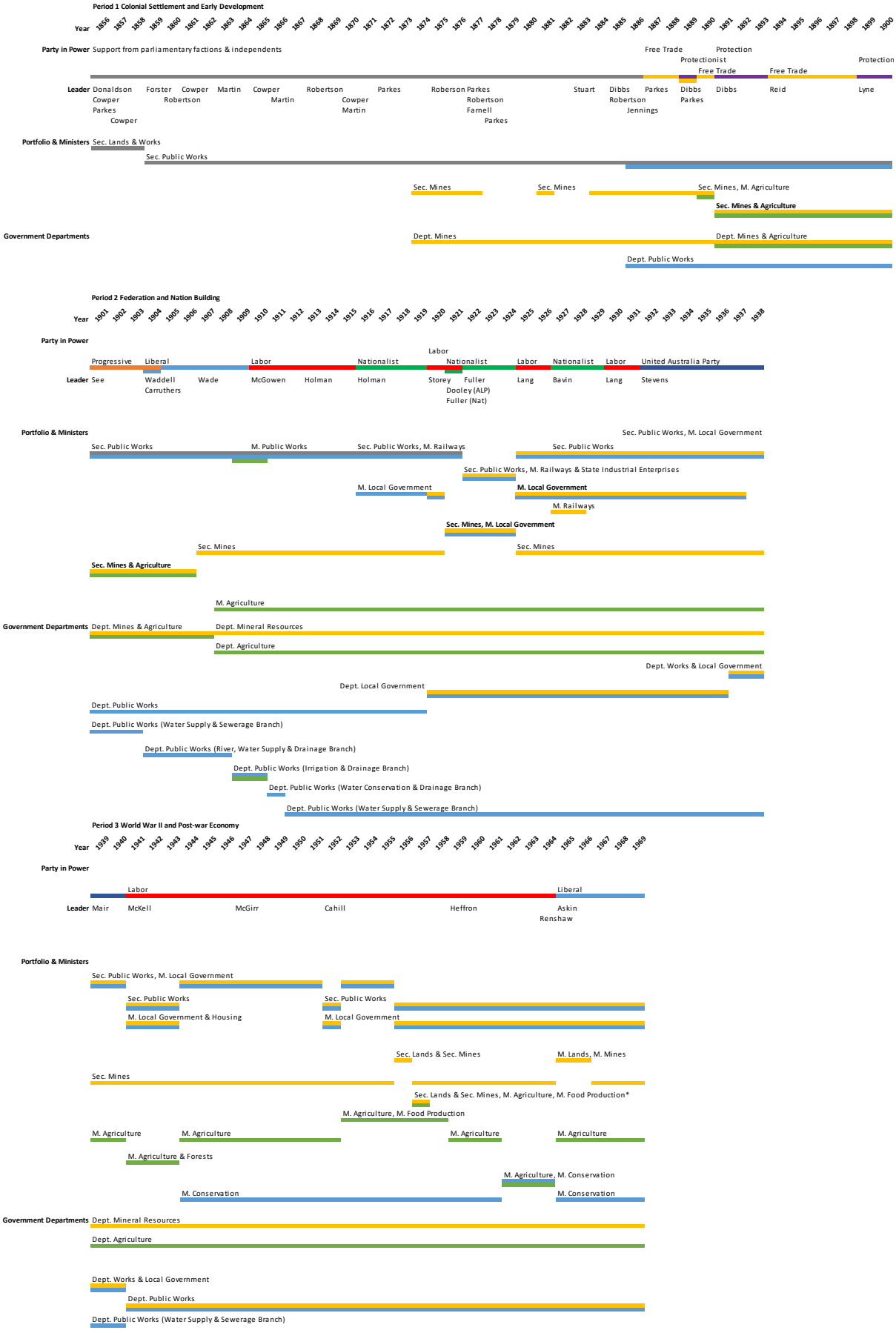

Period 4 Economic Reform, Globalisation and Environmental Awareness
Year
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
Party in Power
Liberal Labor Liberal Labor Liberal
Leader
Gorton McMahon Whitlam Fraser Hawke Keating Howard
Portfolio & Ministers
M. Resources & Energy
M. Trade & Resources
M. Resources
M. National Resources
M. Resources & Energy
M. Industry, Science & Resources
M. Minerals & Energy
M. National Development & Energy
M. National Development
M. Primary Industries & Energy
M. Primary Industry
M. Agriculture, Fisheries & Forestry
M. Agriculture
M. Environment, Aborigines & the Arts
M. Environment & Conservation
M. Environment
M. Environment & Heritage
M. Environment, Housing & Community Development
Government Departments
Dept. of National Resources
Dept. of Resources & Energy
Dept. Minerals & Energy
Dept. of National Development & Energy
Dept. of National Development
Dept. of National Development
Dept. of Industry, Science & Resources
Dept. of Primary Industries & Energy
Dept. Primary Industry
Dept. of Agriculture, Fisheries & Forestry
Dept. of Agriculture
Dept. Environment & Conservation
Dept. the Environment, Sport & Territories
Dept. of the Environment & Heritage
Period 5 Post-reform era and Contemporary Challenges
Year
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Party in Power
Leader
Rudd Gillard Rudd Abbot Turnbull Morrison
Portfolio & Ministers
M. Innovation, Industry, Science & Research
M. Industry, Science & Resources
M. Industry
M. Industry, Tourism & Resources
M. Industry & Science
M. Resources & Energy
M. Industry, Innovation & Science
M. Resources, Energy & Northern Australia
M. Agriculture, Fisheries & Forestry
M. Agriculture
M. Agriculture & Water Resources
M. Climate Change & Water
M. Energy
M. Climate Change, Energy Efficiency & Water
Prime Minister & Cabinet
M. the Environment & Energy
M. Environment & Heritage
M. Environment & Water Resources
M. Environment, Water, Heritage & the Arts
M. Sustainability, Environment, Water, Population & Communities
Government Departments
Dept. Resources, Energy & Tourism
Dept. Industry
Dept. Industry, Tourism & Resources
Dept. Industry & Science
Dept. Climate Change
Dept. Industry, Innovation & Science
Dept. of Industry, Science & Resources
Dept. Climate Change & Energy Efficiency
Dept. of Agriculture, Fisheries & Forestry
Dept. Agriculture & Water
Dept. the Prime Minister & Cabinet
Dept. Agriculture
Dept. Environment & Water Resources (LIB)
Dept. Environment & Energy
Dept. of the Environment & Heritage
Dept. Environment, Water, Heritage & the Arts
Dept. Sustainability, Environment, Water, Population & Communities
Dept. Environment

Figure H2. New South Wales



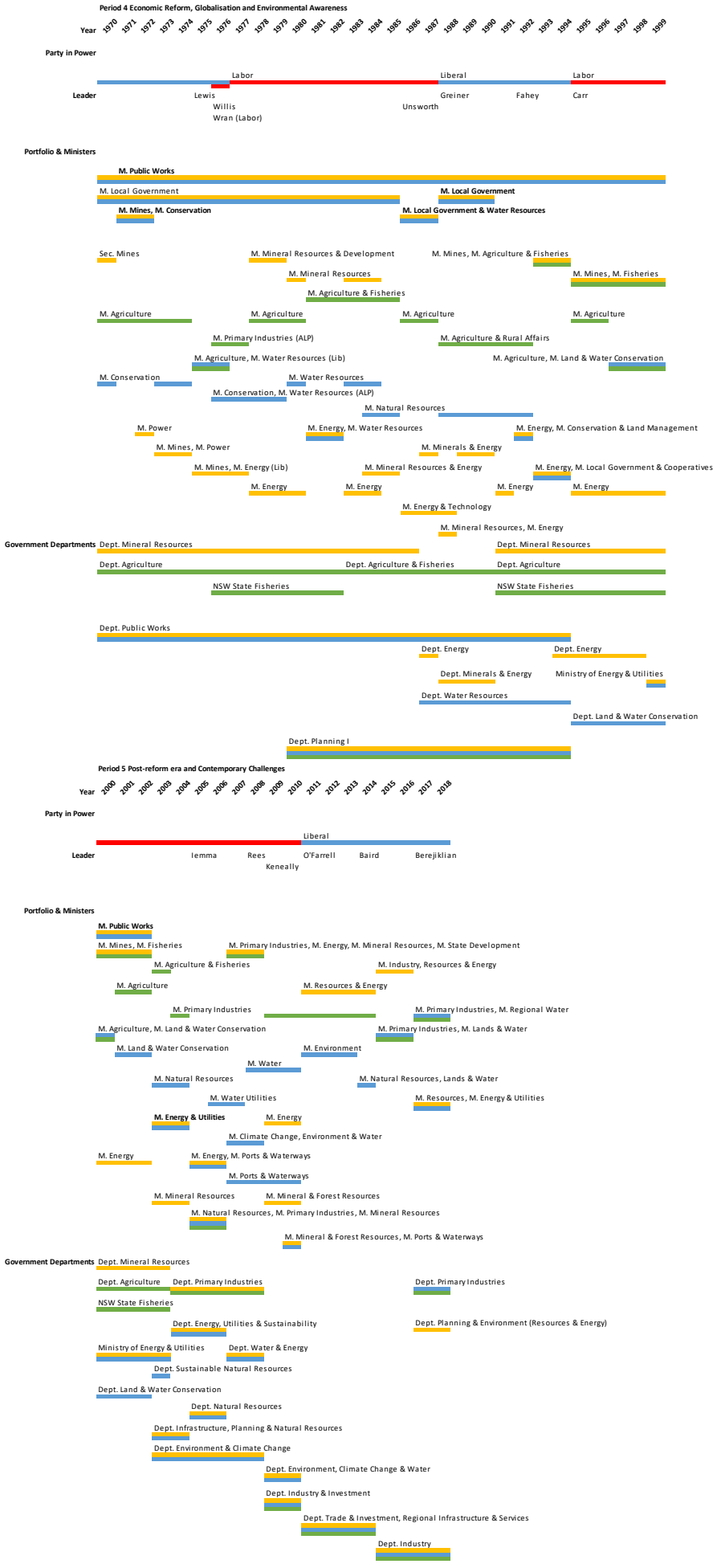
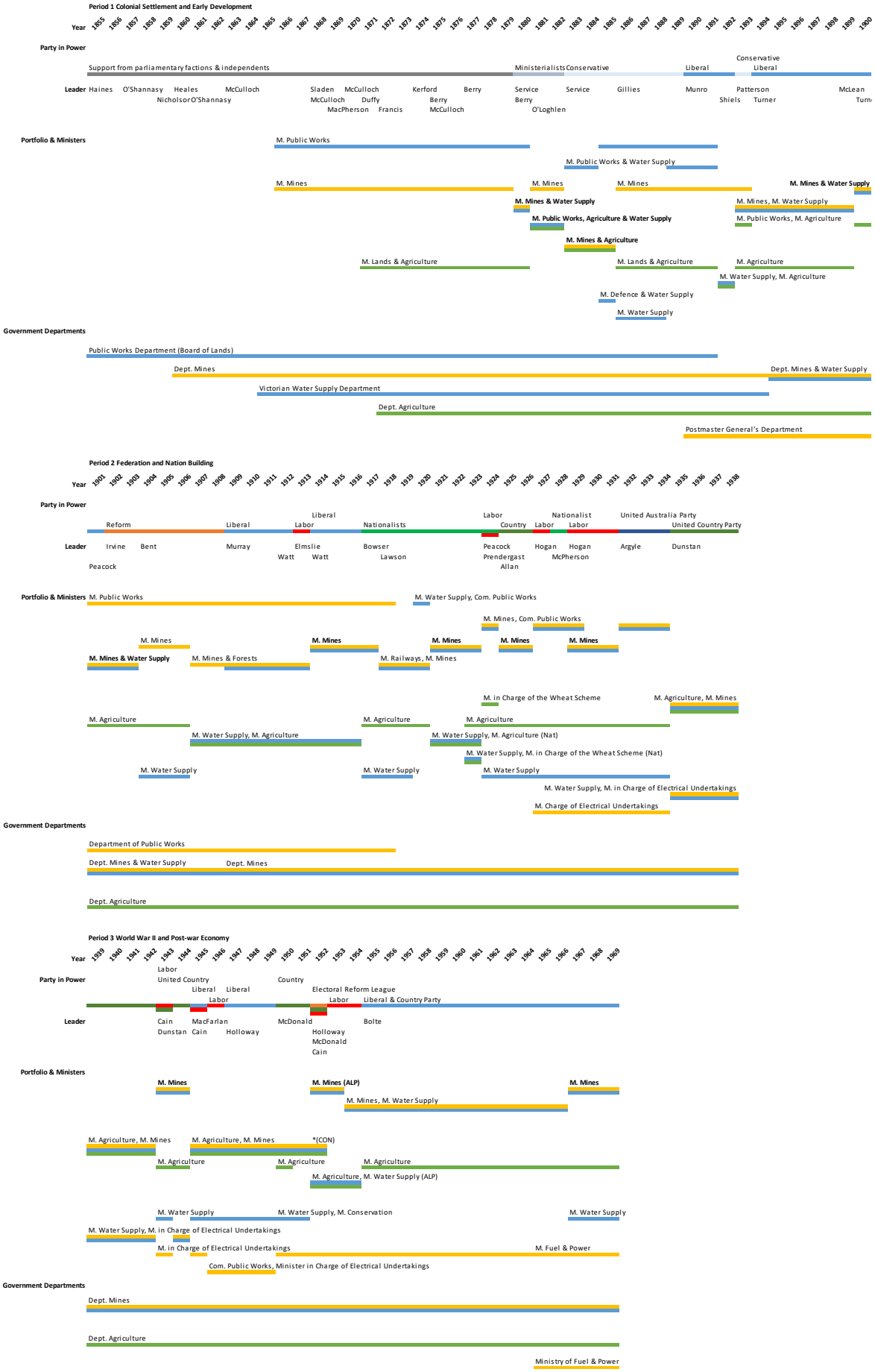

Period 4 Economic Reform, Globalisation and Environmental Awareness
Year
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
Party in Power
Labor
Liberal
Labor
Leader
Lewis
Willis
Wran (Labor)
Greiner
Unsworth
Fahey
Carr
Portfolio & Ministers
M. Public Works
M. Local Government
M. Local Government
M. Mines, M. Conservation
M. Local Government & Water Resources
Sec. Mines
M. Mineral Resources & Development
M. Mines, M. Agriculture & Fisheries
M. Mineral Resources
M. Mines, M. Fisheries
M. Agriculture & Fisheries
M. Agriculture
M. Agriculture
M. Agriculture
M. Agriculture
M. Primary Industries (ALP)
M. Agriculture & Rural Affairs
M. Agriculture, M. Water Resources (Lib)
M. Agriculture, M. Land & Water Conservation
M. Conservation
M. Water Resources
M. Conservation, M. Water Resources (ALP)
M. Natural Resources
M. Power
M. Energy, M. Water Resources
M. Energy, M. Conservation & Land Management
M. Mines, M. Power
M. Minerals & Energy
M. Mines, M. Energy (Lib)
M. Mineral Resources & Energy
M. Energy, M. Local Government & Cooperatives
M. Energy
M. Energy
M. Energy
M. Energy
M. Energy & Technology
M. Mineral Resources, M. Energy
Government Departments
Dept. Mineral Resources
Dept. Mineral Resources
Dept. Agriculture
Dept. Agriculture & Fisheries
Dept. Agriculture
NSW State Fisheries
NSW State Fisheries
Dept. Public Works
Dept. Energy
Dept. Energy
Dept. Minerals & Energy
Ministry of Energy & Utilities
Dept. Water Resources
Dept. Land & Water Conservation
Dept. Planning I
Period 5 Post-reform era and Contemporary Challenges
Year
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Party in Power
Liberal
Leader
Iemma
Rees
O'Farrell
Baird
Berejiklian
Keneally
Portfolio & Ministers
M. Public Works
M. Mines, M. Fisheries
M. Primary Industries, M. Energy, M. Mineral Resources, M. State Development
M. Agriculture & Fisheries
M. Industry, Resources & Energy
M. Agriculture
M. Resources & Energy
M. Primary Industries
M. Primary Industries, M. Regional Water
M. Agriculture, M. Land & Water Conservation
M. Primary Industries, M. Lands & Water
M. Land & Water Conservation
M. Environment
M. Water
M. Natural Resources
M. Natural Resources, Lands & Water
M. Water Utilities
M. Resources, M. Energy & Utilities
M. Energy & Utilities
M. Energy
M. Climate Change, Environment & Water
M. Energy
M. Energy, M. Ports & Waterways
M. Ports & Waterways
M. Mineral Resources
M. Mineral & Forest Resources
M. Natural Resources, M. Primary Industries, M. Mineral Resources
M. Mineral & Forest Resources, M. Ports & Waterways
Government Departments
Dept. Mineral Resources
Dept. Agriculture
Dept. Primary Industries
Dept. Primary Industries
NSW State Fisheries
Dept. Energy, Utilities & Sustainability
Dept. Planning & Environment (Resources & Energy)
Ministry of Energy & Utilities
Dept. Water & Energy
Dept. Sustainable Natural Resources
Dept. Land & Water Conservation
Dept. Natural Resources
Dept. Infrastructure, Planning & Natural Resources
Dept. Environment & Climate Change
Dept. Environment, Climate Change & Water
Dept. Industry & Investment
Dept. Trade & Investment, Regional Infrastructure & Services
Dept. Industry

Figure H3. Victoria



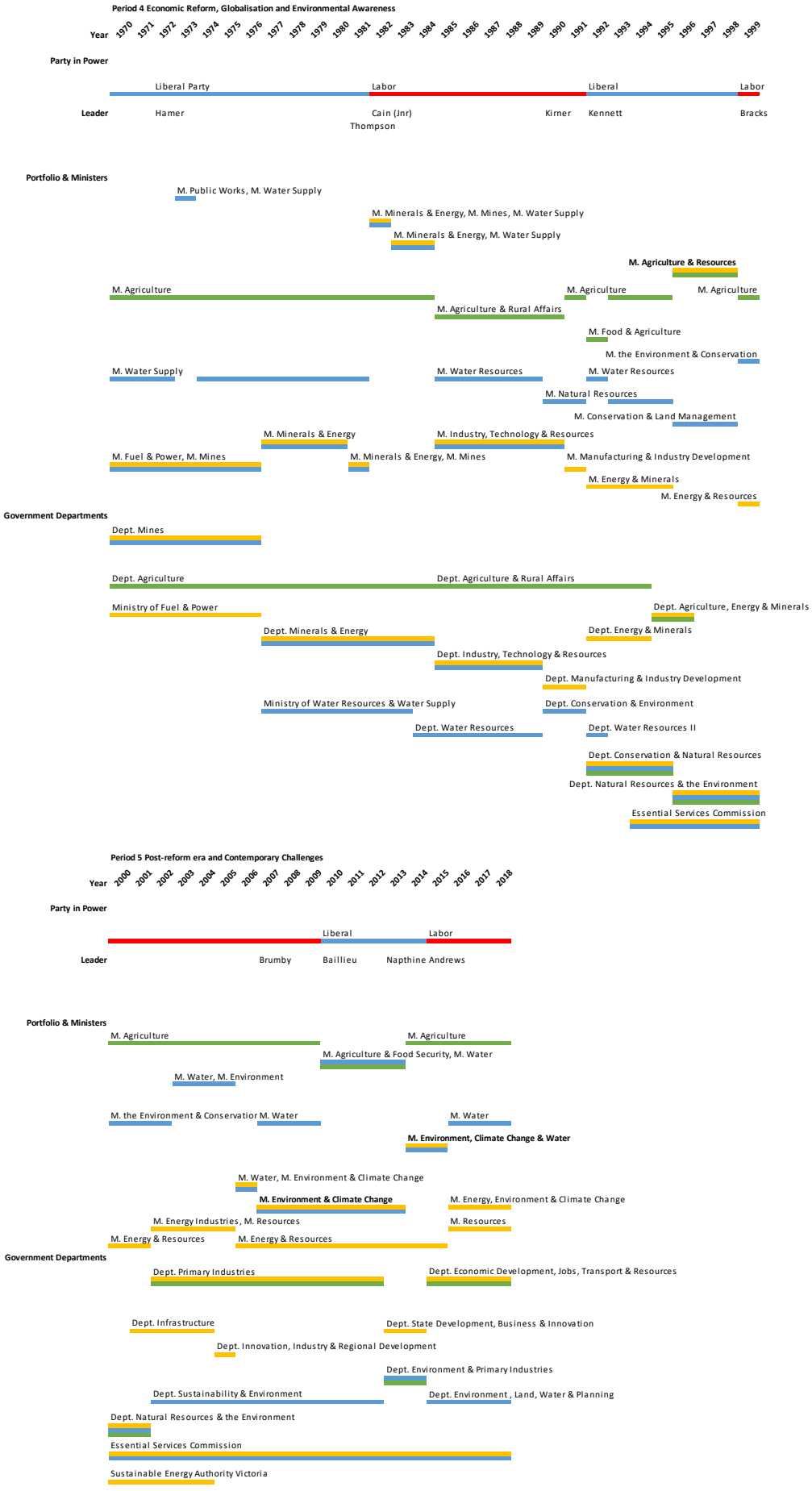
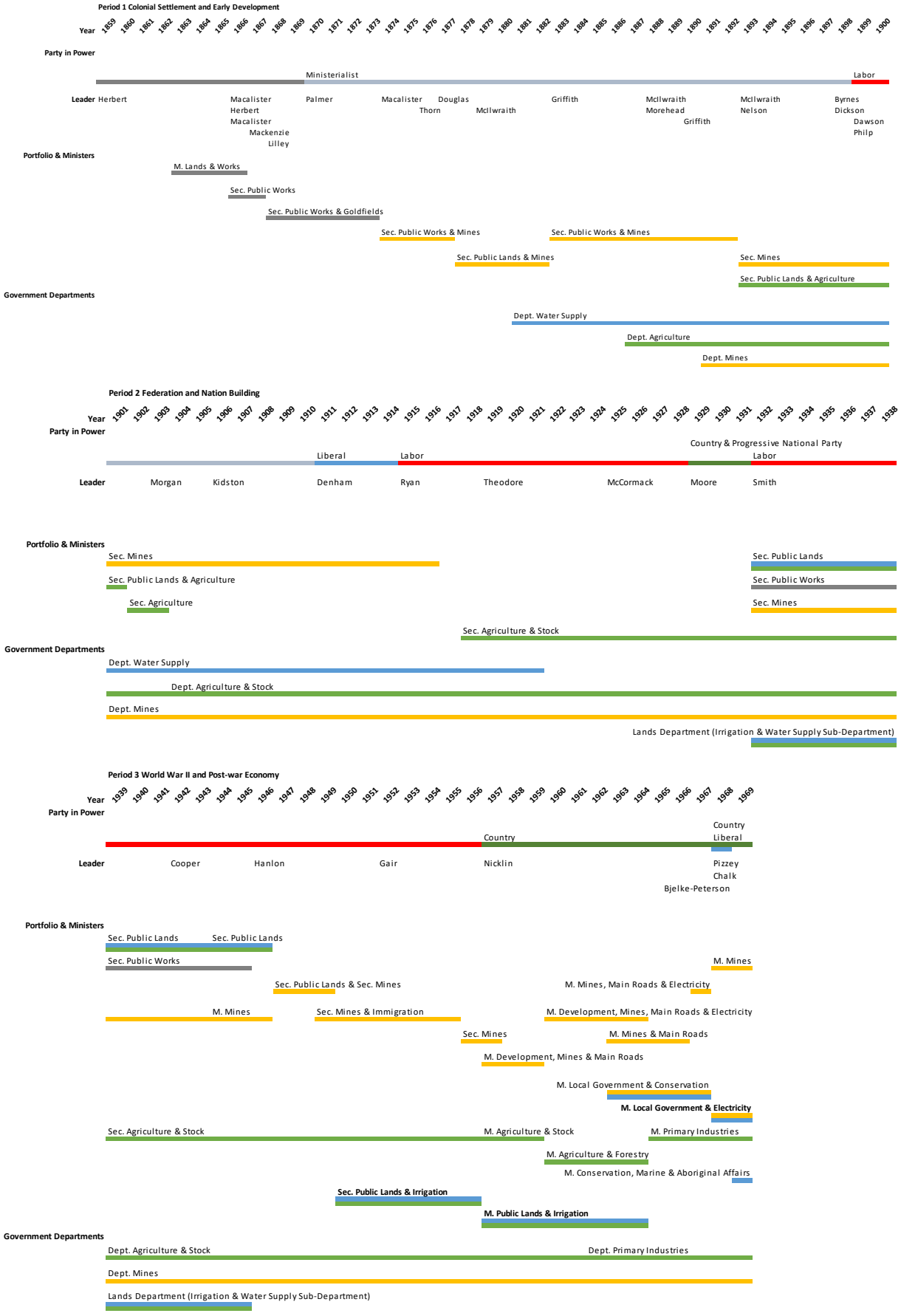
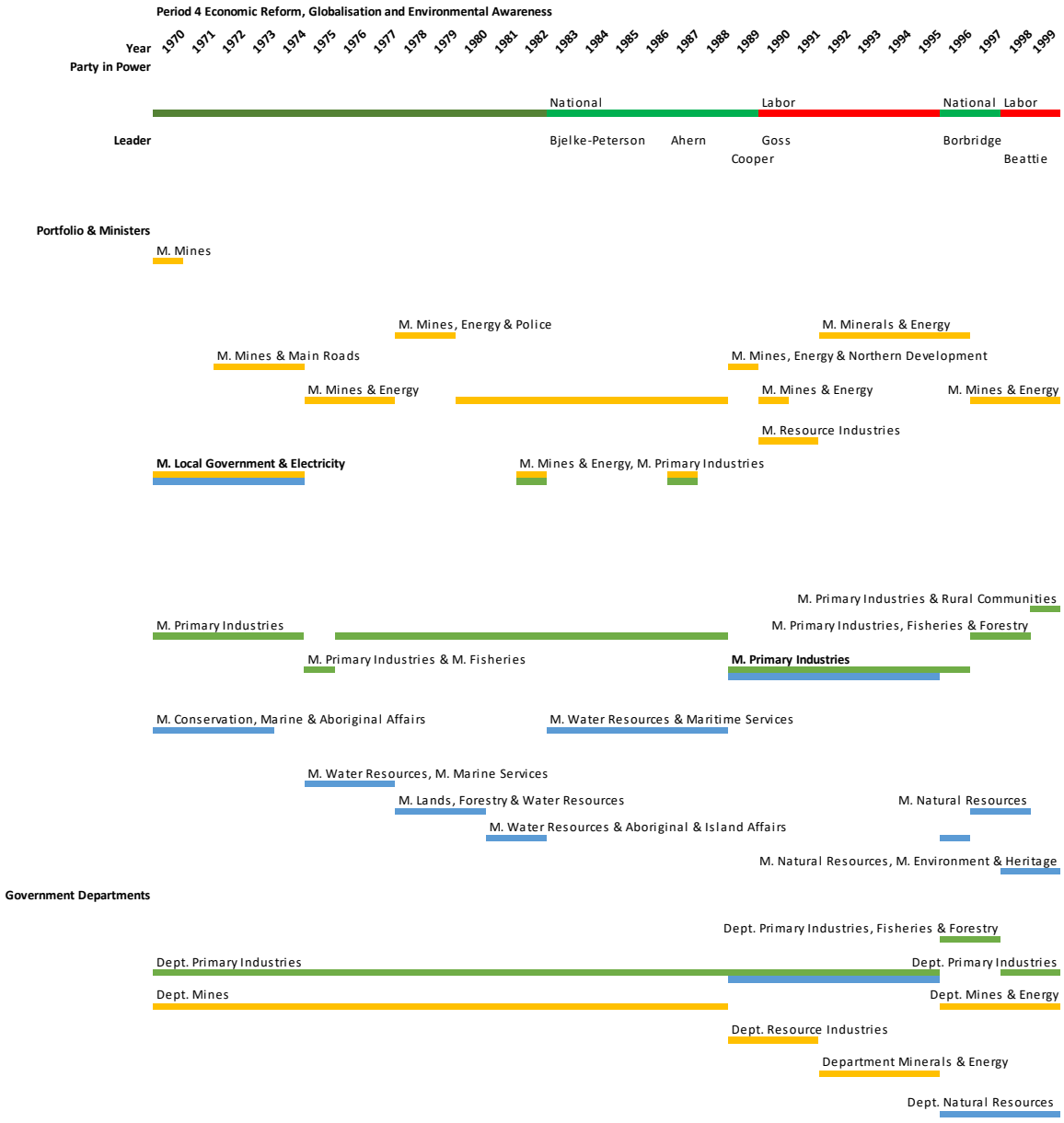

Period 4 Economic Reform, Globalisation and Environmental Awareness
Year
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
Party in Power
Liberal Party
Labor
Liberal
Labor
Leader
Hamer
Cain (Jnr)
Thompson
Kirner
Kennett
Bracks
Portfolio & Ministers
M. Public Works, M. Water Supply
M. Minerals & Energy, M. Mines, M. Water Supply
M. Minerals & Energy, M. Water Supply
M. Agriculture & Resources
M. Agriculture
M. Agriculture
M. Agriculture
M. Agriculture & Rural Affairs
M. Food & Agriculture
M. the Environment & Conservation
M. Water Supply
M. Water Resources
M. Water Resources
M. Natural Resources
M. Conservation & Land Management
M. Minerals & Energy
M. Industry, Technology & Resources
M. Fuel & Power, M. Mines
M. Minerals & Energy, M. Mines
M. Manufacturing & Industry Development
M. Energy & Minerals
M. Energy & Resources
Government Departments
Dept. Mines
Dept. Agriculture
Dept. Agriculture & Rural Affairs
Ministry of Fuel & Power
Dept. Agriculture, Energy & Minerals
Dept. Minerals & Energy
Dept. Energy & Minerals
Dept. Industry, Technology & Resources
Dept. Manufacturing & Industry Development
Ministry of Water Resources & Water Supply
Dept. Conservation & Environment
Dept. Water Resources
Dept. Water Resources II
Dept. Conservation & Natural Resources
Dept. Natural Resources & the Environment
Essential Services Commission
Period 5 Post-reform era and Contemporary Challenges
Year
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Party in Power
Liberal
Labor
Leader
Brumby
Baillieu
Napthine
Andrews
Portfolio & Ministers
M. Agriculture
M. Agriculture
M. Agriculture & Food Security, M. Water
M. Water, M. Environment
M. the Environment & Conservatior
M. Water
M. Water
M. Environment, Climate Change & Water
M. Water, M. Environment & Climate Change
M. Environment & Climate Change
M. Energy, Environment & Climate Change
M. Energy Industries, M. Resources
M. Resources
M. Energy & Resources
M. Energy & Resources
Government Departments
Dept. Primary Industries
Dept. Economic Development, Jobs, Transport & Resources
Dept. Infrastructure
Dept. State Development, Business & Innovation
Dept. Innovation, Industry & Regional Development
Dept. Environment & Primary Industries
Dept. Sustainability & Environment
Dept. Environment , Land, Water & Planning
Dept. Natural Resources & the Environment
Essential Services Commission
Sustainable Energy Authority Victoria

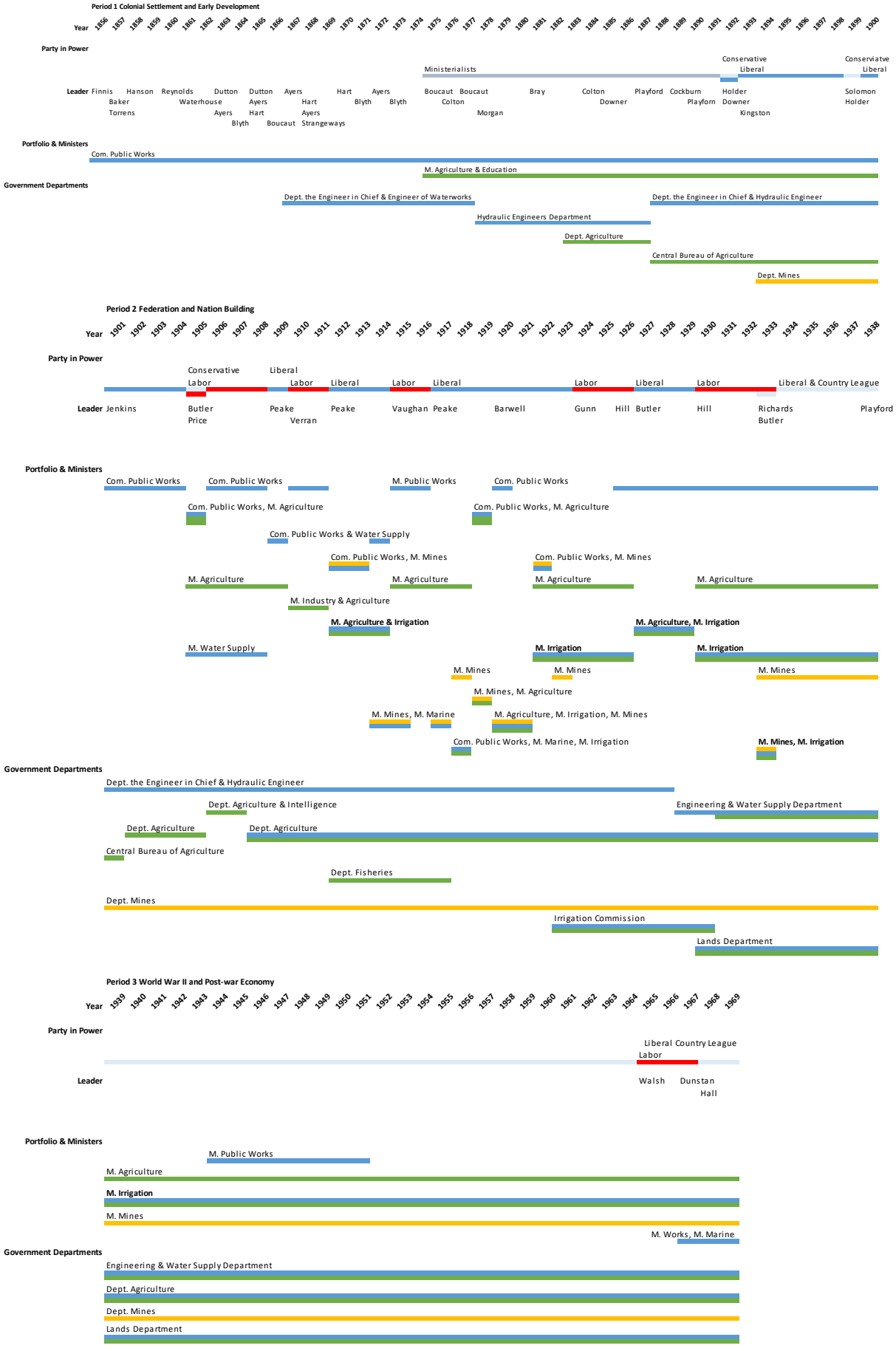
Figure H5. Queensland




Period 4 Economic Reform, Globalisation and Environmental Awareness
Year
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
Party in Power
National
Labor
National
Labor
Leader
Bjelke-Peterson
Ahern
Goss
Cooper
Borbridge
Beattie
Portfolio & Ministers
M. Mines
M. Mines, Energy & Police
M. Minerals & Energy
M. Mines & Main Roads
M. Mines, Energy & Northern Development
M. Mines & Energy
M. Mines & Energy
M. Mines & Energy
M. Resource Industries
M. Local Government & Electricity
M. Mines & Energy, M. Primary Industries
M. Primary Industries & Rural Communities
M. Primary Industries
M. Primary Industries, Fisheries & Forestry
M. Primary Industries & M. Fisheries
M. Primary Industries
M. Conservation, Marine & Aboriginal Affairs
M. Water Resources & Maritime Services
M. Water Resources, M. Marine Services
M. Lands, Forestry & Water Resources
M. Natural Resources
M. Water Resources & Aboriginal & Island Affairs
M. Natural Resources, M. Environment & Heritage
Government Departments
Dept. Primary Industries, Fisheries & Forestry
Dept. Primary Industries
Dept. Primary Industries
Dept. Mines
Dept. Mines & Energy
Dept. Resource Industries
Department Minerals & Energy
Dept. Natural Resources


Period 5 Post-reform era and Contemporary Challenges
Year
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Party in Power
Liberal
Labor
Leader
Bligh
Newman
Palaszczuk
Portfolio & Ministers
M. Energy & Aboriginal & Torres Strait Islander Policy
M. Innovation & Information Economy
M. Energy
M. Mines & Energy
M. Mines & Energy
M. Mines & Energy, M. Natural Resources
M. Natural Resources, Mines & Energy
M. Natural Resources, Mines & Energy
M. Natural Resources & Mines
M. Energy & Water Utilities
M. Energy & Water Supply
M. Primary Industries & Rural Communities
M. Energy, Biofuels & Water Supply
M. Primary Industries, Fisheries & Rural & Regional Queensland
M. Primary Industries & Fisheries
M. Agriculture, Food & Regional Econom
M. Agriculture & Food
M. Agricultural Industry Development & Fisheries
M. Agriculture & Fisheries, M. Rural & Economic Development
M. Agriculture & Fisheries
M. Main Roads, Fisheries & Marine Infrastructure
M. Natural Resources & Water
M. Environment & Heritage Protecti
M. Natural Resources, M. Environment & Heritage
M. Environment & Resource Managemer
M. Environment
M. Natural Resources & The Arts
Government Departments
Dept. Primary Industries, Fisheries & Forestry
Dept. Agriculture, Fisheries & Forestry
Dept. Primary Industries
Dept. Agriculture & Fisheries
Dept. Mines & Energy
Dept. Energy
Dept. Employment, Economic Development & Inno
Dept. Natural Resources
Dept. Energy & Water Supply
Dept. Natural Resources & Mines
Dept. Natural Resources & Mines
Dept. Natural Resources, Mines & Energy
Dept. Natural Resources, Mines & Water
Dept. Natural Resources, Mines & Energy
Dept. Natural Resources & Water
Dept. Environment & Resource Management
Dept. Environment & Heritage Protection
Dept. Environment & Science

Figure H4. South Australia



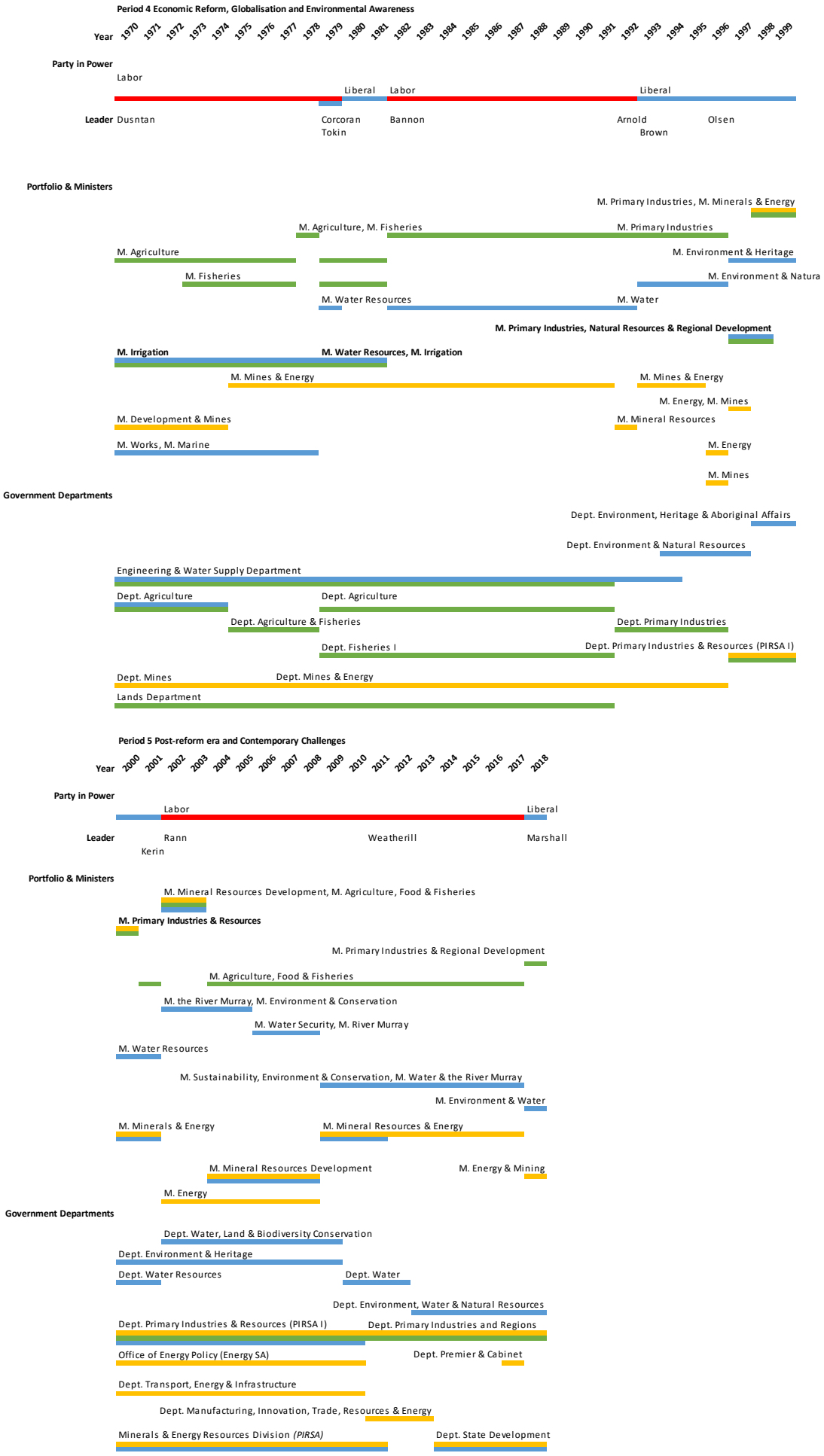
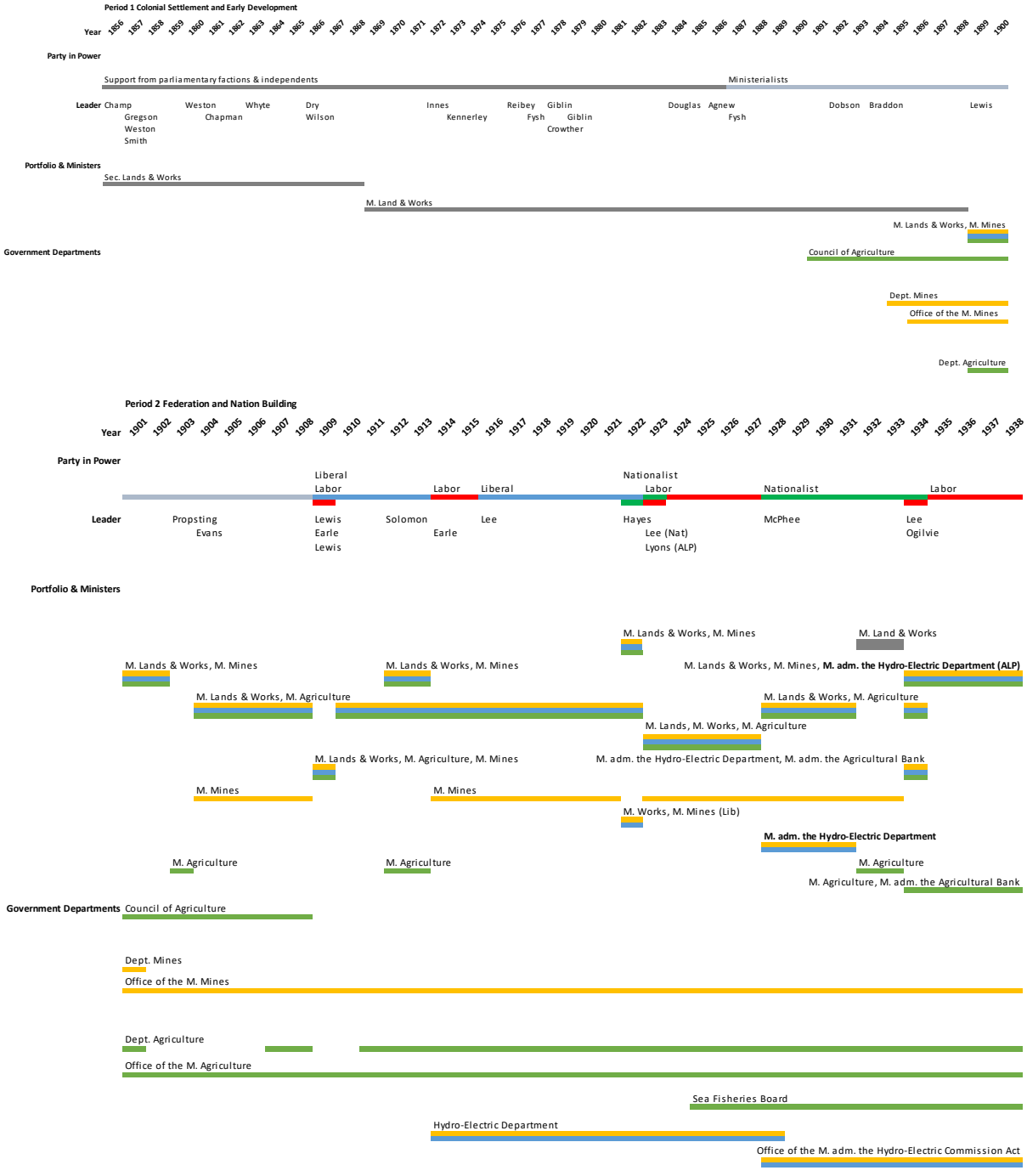
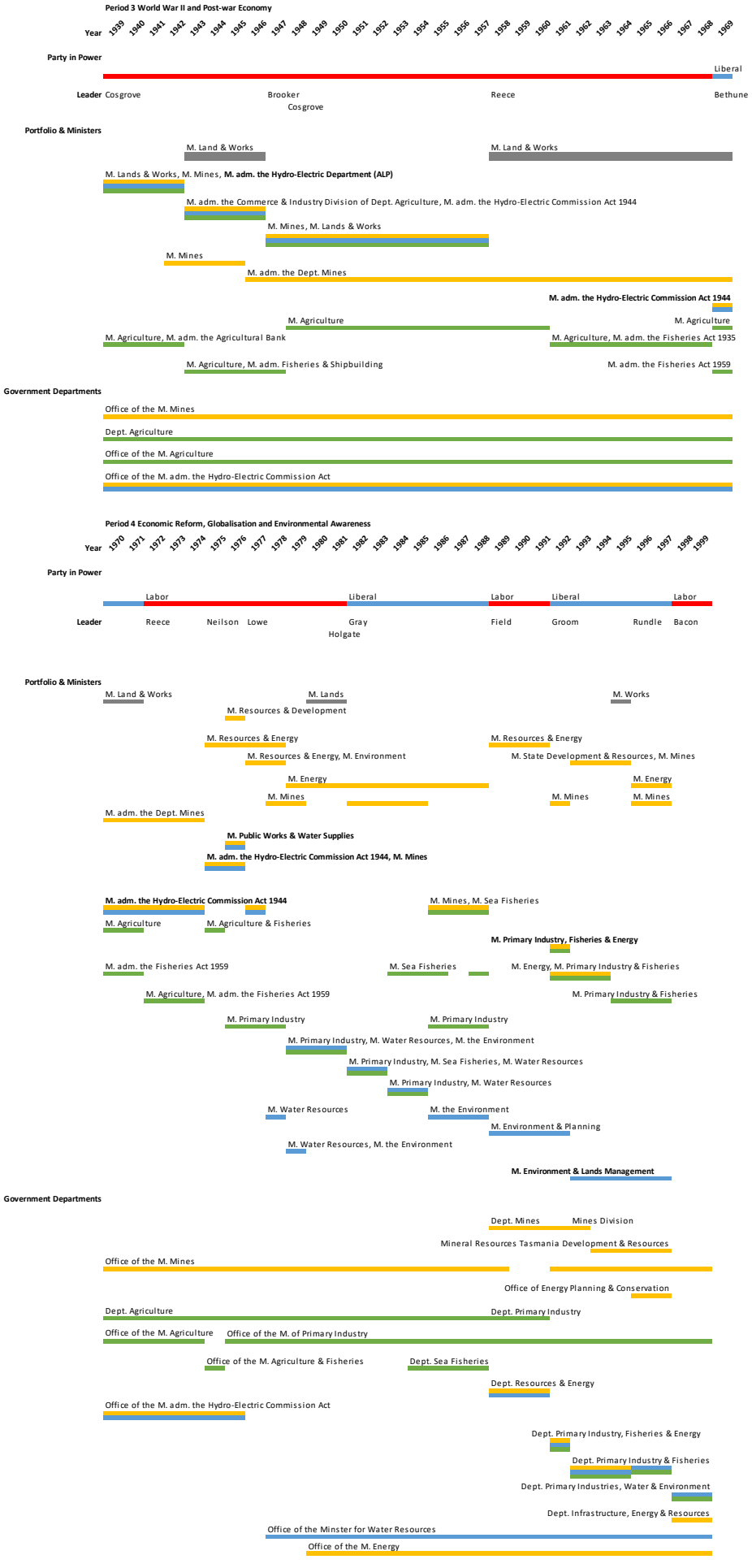

Period 4 Economic Reform, Globalisation and Environmental Awareness
Year
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
Party in Power
Labor
Liberal
Labor
Liberal
Leader
Dusntan
Corcoran
Tokin
Bannon
Arnold
Brown
Olsen
Portfolio & Ministers
M. Primary Industries, M. Minerals & Energy
M. Agriculture, M. Fisheries
M. Primary Industries
M. Agriculture
M. Environment & Heritage
M. Fisheries
M. Environment & Natura
M. Water Resources
M. Water
M. Primary Industries, Natural Resources & Regional Development
M. Irrigation
M. Water Resources, M. Irrigation
M. Mines & Energy
M. Mines & Energy
M. Energy, M. Mines
M. Development & Mines
M. Mineral Resources
M. Works, M. Marine
M. Energy
M. Mines
Government Departments
Dept. Environment, Heritage & Aboriginal Affairs
Dept. Environment & Natural Resources
Engineering & Water Supply Department
Dept. Agriculture
Dept. Agriculture
Dept. Agriculture & Fisheries
Dept. Primary Industries
Dept. Fisheries I
Dept. Primary Industries & Resources (PIRSA I)
Dept. Mines
Dept. Mines & Energy
Lands Department
Period 5 Post-reform era and Contemporary Challenges
Year
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Party in Power
Labor
Liberal
Leader
Rann
Kerin
Weatherill
Marshall
Portfolio & Ministers
M. Mineral Resources Development, M. Agriculture, Food & Fisheries
M. Primary Industries & Resources
M. Primary Industries & Regional Development
M. Agriculture, Food & Fisheries
M. the River Murray, M. Environment & Conservation
M. Water Security, M. River Murray
M. Water Resources
M. Sustainability, Environment & Conservation, M. Water & the River Murray
M. Environment & Water
M. Minerals & Energy
M. Mineral Resources & Energy
M. Mineral Resources Development
M. Energy & Mining
M. Energy
Government Departments
Dept. Water, Land & Biodiversity Conservation
Dept. Environment & Heritage
Dept. Water Resources
Dept. Water
Dept. Environment, Water & Natural Resources
Dept. Primary Industries & Resources (PIRSA I)
Dept. Primary Industries and Regions
Office of Energy Policy (Energy SA)
Dept. Premier & Cabinet
Dept. Transport, Energy & Infrastructure
Dept. Manufacturing, Innovation, Trade, Resources & Energy
Minerals & Energy Resources Division (PIRSA)
Dept. State Development

Figure H6. Tasmania




Period 3 World War II and Post-war Economy
Year
1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969
Party in Power
Liberal
Leader
Cosgrove
Brooker
Cosgrove
Reece
Bethune
Portfolio & Ministers
M. Land & Works
M. Land & Works
M. Lands & Works, M. Mines, M. adm. the Hydro-Electric Department (ALP)
M. adm. the Commerce & Industry Division of Dept. Agriculture, M. adm. the Hydro-Electric Commission Act 1944
M. Mines, M. Lands & Works
M. Mines
M. adm. the Dept. Mines
M. adm. the Hydro-Electric Commission Act 1944
M. Agriculture
M. Agriculture
M. Agriculture, M. adm. the Agricultural Bank
M. Agriculture, M. adm. the Fisheries Act 1935
M. Agriculture, M. adm. Fisheries & Shipbuilding
M. adm. the Fisheries Act 1959
Government Departments
Office of the M. Mines
Dept. Agriculture
Office of the M. Agriculture
Office of the M. adm. the Hydro-Electric Commission Act
Period 4 Economic Reform, Globalisation and Environmental Awareness
Year
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
Party in Power
Labor
Liberal
Labor
Liberal
Labor
Leader
Reece
Neilson
Lowe
Gray
Holgate
Field
Groom
Rundle
Bacon
Portfolio & Ministers
M. Land & Works
M. Lands
M. Works
M. Resources & Development
M. Resources & Energy
M. Resources & Energy
M. Resources & Energy, M. Environment
M. State Development & Resources, M. Mines
M. Energy
M. Energy
M. Mines
M. Mines
M. Mines
M. adm. the Dept. Mines
M. Public Works & Water Supplies
M. adm. the Hydro-Electric Commission Act 1944, M. Mines
M. adm. the Hydro-Electric Commission Act 1944
M. Mines, M. Sea Fisheries
M. Agriculture
M. Agriculture & Fisheries
M. Primary Industry, Fisheries & Energy
M. adm. the Fisheries Act 1959
M. Sea Fisheries
M. Energy, M. Primary Industry & Fisheries
M. Agriculture, M. adm. the Fisheries Act 1959
M. Primary Industry & Fisheries
M. Primary Industry
M. Primary Industry
M. Primary Industry, M. Water Resources, M. the Environment
M. Primary Industry, M. Sea Fisheries, M. Water Resources
M. Primary Industry, M. Water Resources
M. Water Resources
M. the Environment
M. Environment & Planning
M. Water Resources, M. the Environment
M. Environment & Lands Management
Government Departments
Dept. Mines
Mines Division
Mineral Resources Tasmania Development & Resources
Office of the M. Mines
Office of Energy Planning & Conservation
Dept. Agriculture
Dept. Primary Industry
Office of the M. Agriculture
Office of the M. of Primary Industry
Office of the M. Agriculture & Fisheries
Dept. Sea Fisheries
Dept. Resources & Energy
Office of the M. adm. the Hydro-Electric Commission Act
Dept. Primary Industry, Fisheries & Energy
Dept. Primary Industry & Fisheries
Dept. Primary Industries, Water & Environment
Dept. Infrastructure, Energy & Resources
Office of the Minster for Water Resources
Office of the M. Energy

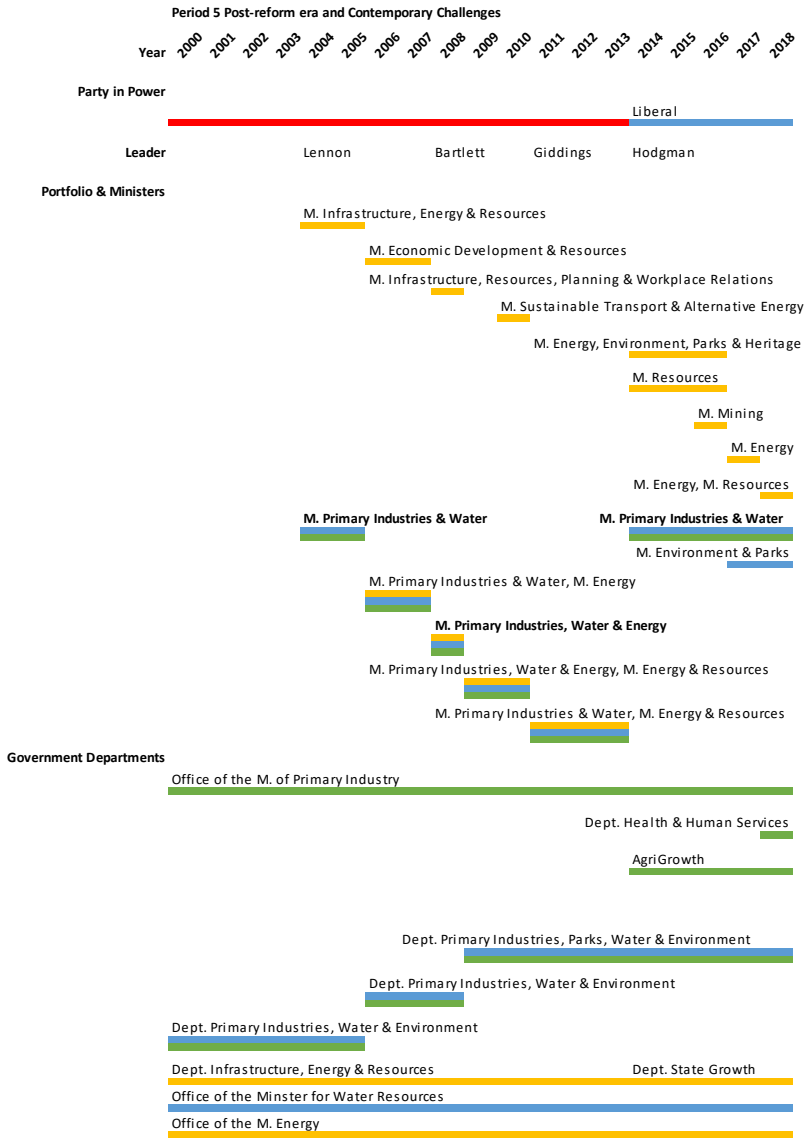
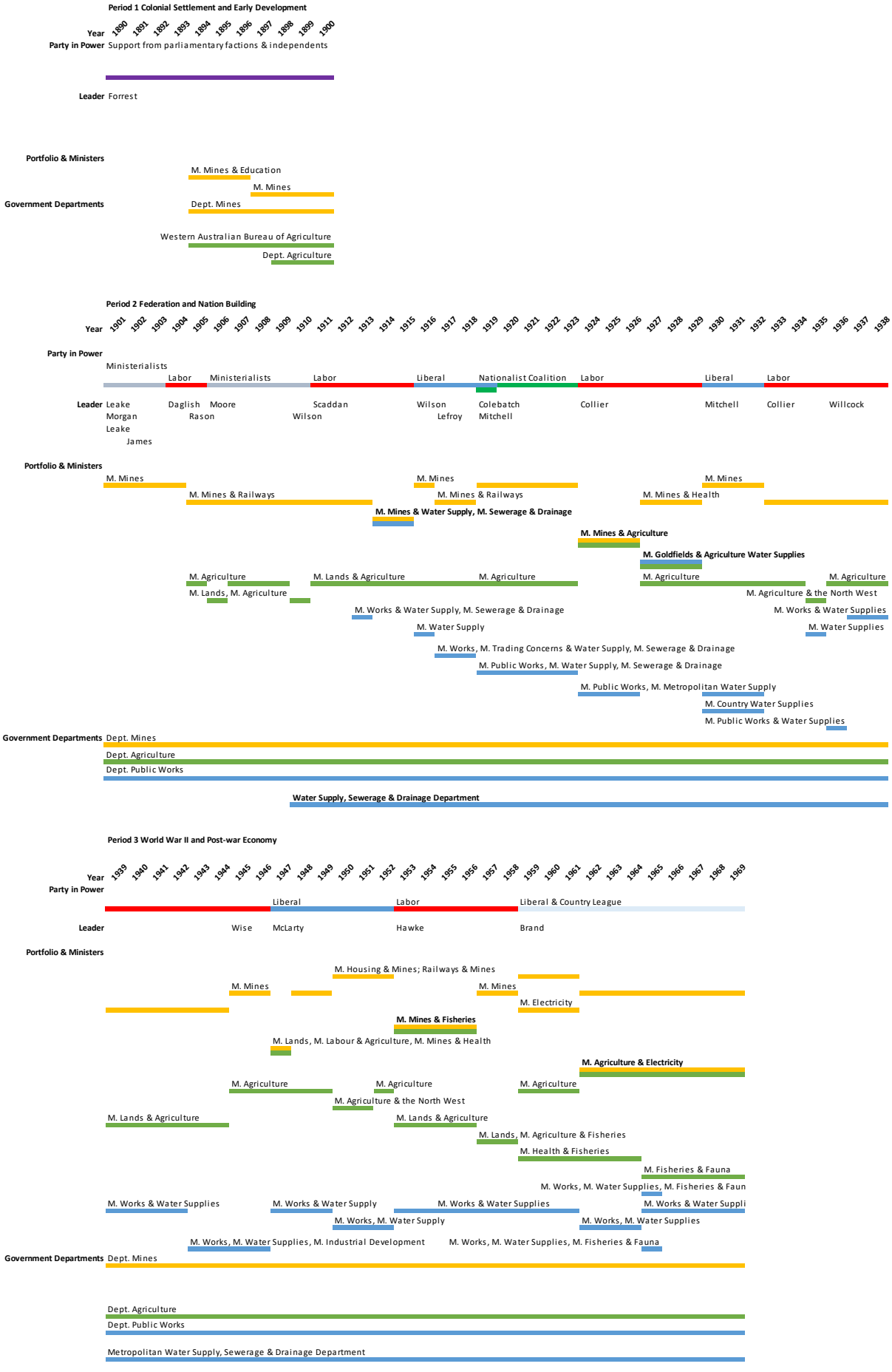
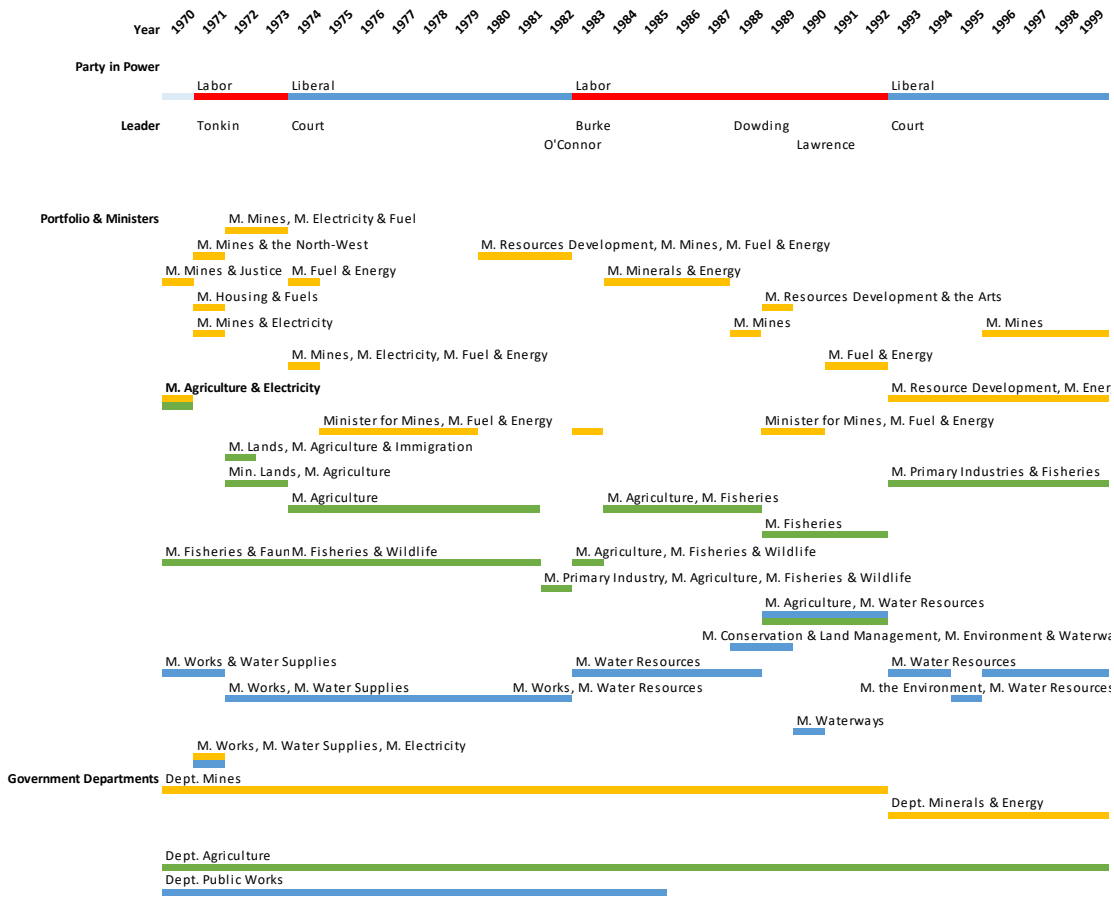

Period 5 Post-reform era and Contemporary Challenges
Year
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Party in Power
Liberal
Leader
Lennon
Bartlett
Giddings
Hodgman
Portfolio & Ministers
M. Infrastructure, Energy & Resources
M. Economic Development & Resources
M. Infrastructure, Resources, Planning & Workplace Relations
M. Sustainable Transport & Alternative Energy
M. Energy, Environment, Parks & Heritage
M. Resources
M. Mining
M. Energy
M. Energy, M. Resources
M. Primary Industries & Water
M. Primary Industries & Water
M. Environment & Parks
M. Primary Industries & Water, M. Energy
M. Primary Industries, Water & Energy
M. Primary Industries, Water & Energy, M. Energy & Resources
M. Primary Industries & Water, M. Energy & Resources
Government Departments
Office of the M. of Primary Industry
Dept. Health & Human Services
AgriGrowth
Dept. Primary Industries, Parks, Water & Environment
Dept. Primary Industries, Water & Environment
Dept. Primary Industries, Water & Environment
Dept. Infrastructure, Energy & Resources
Dept. State Growth
Office of the Minster for Water Resources
Office of the M. Energy

Figure H7. Western Australia



Period 4 Economic Reform, Globalisation and Environmental Awareness



Period 5 Post-reform era and Contemporary Challenges

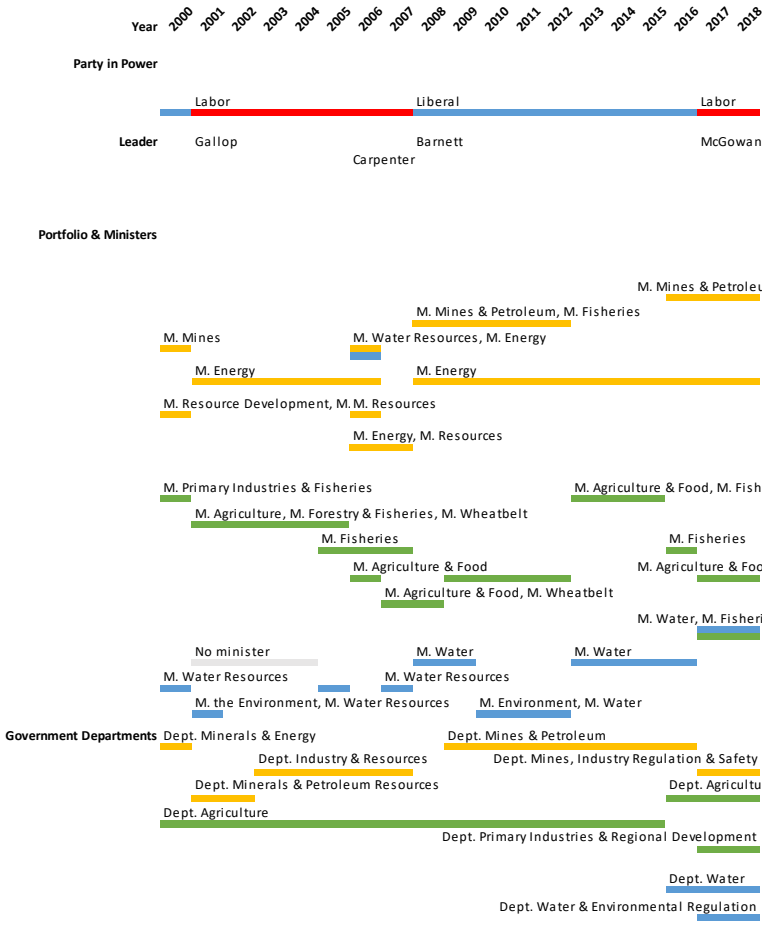


Figure H8. Northern Territory

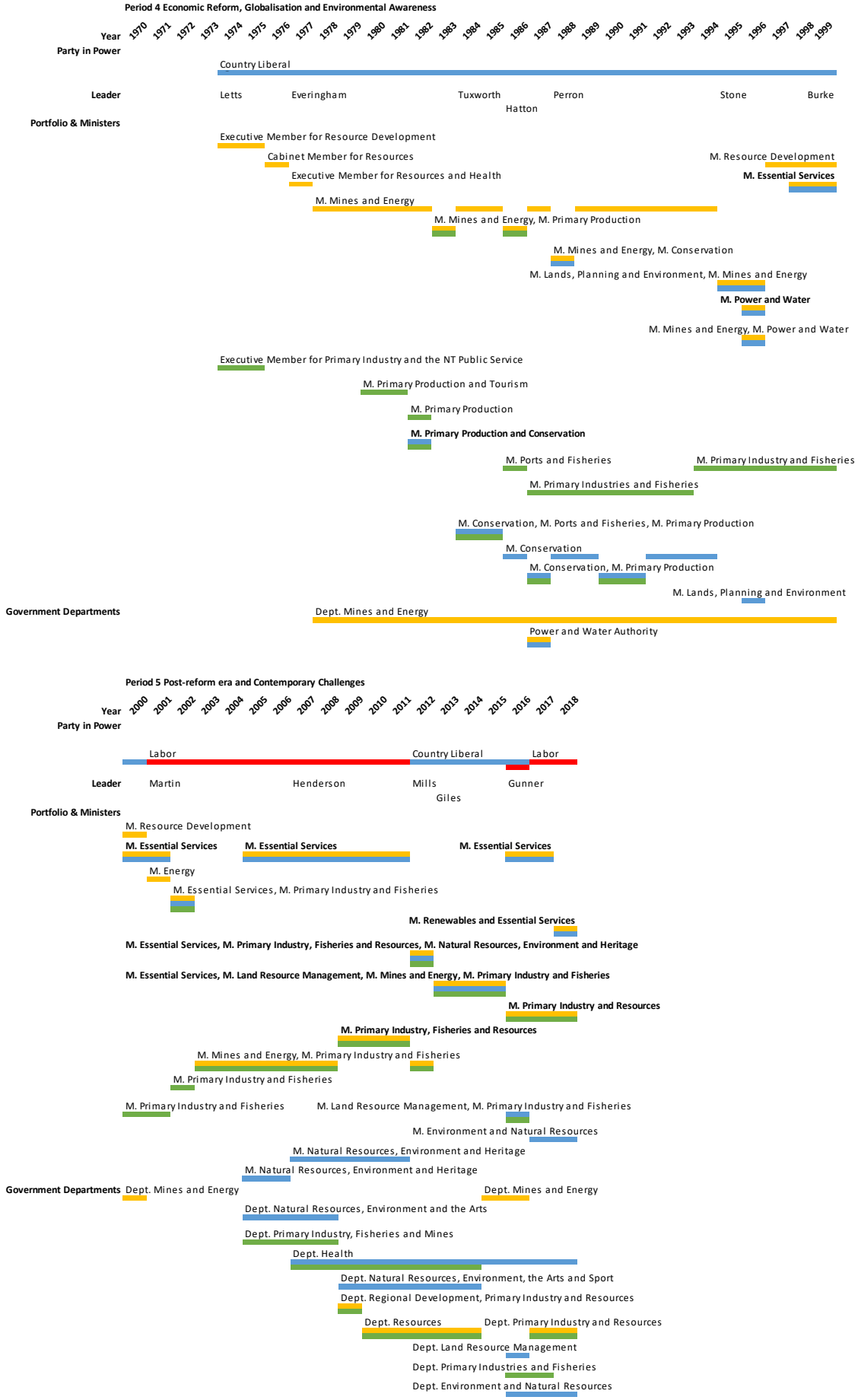
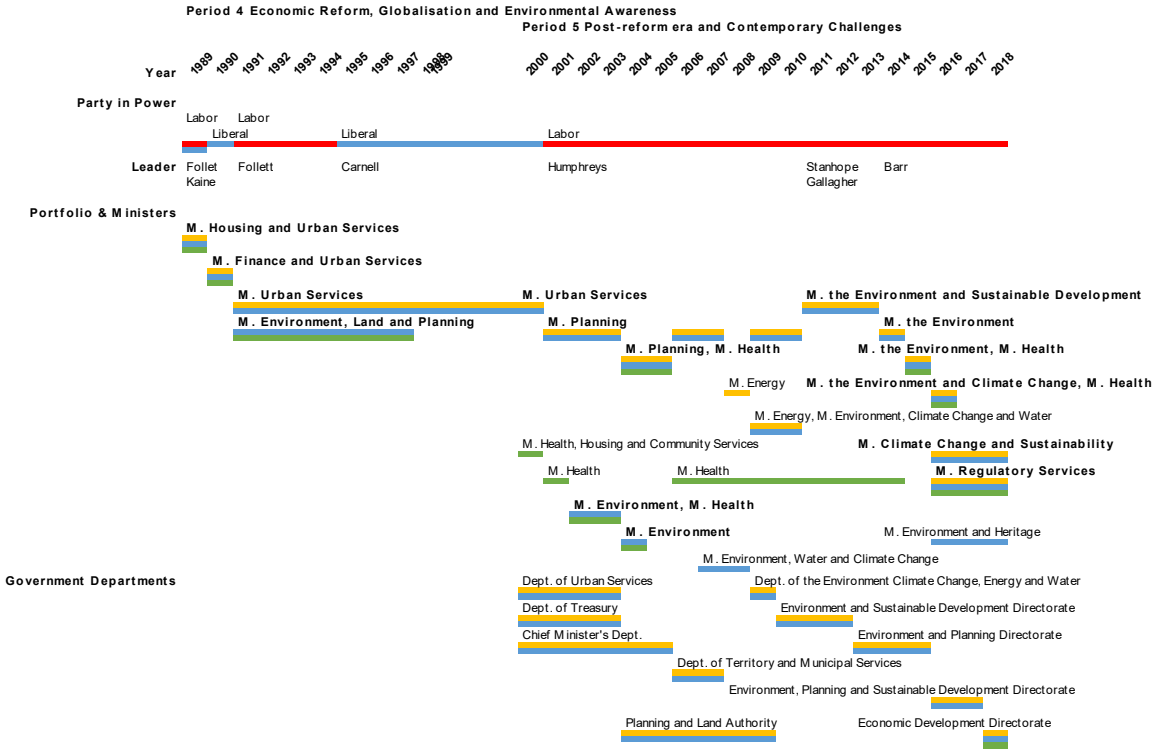


Figure H9. Australian Capital Territory



Appendix I. Count of years with integration

Based on the timelines developed above the following tables, show the count of years held by a minister and government department with multiple sector responsibilities also categorised into party (Non-Labor or Labor).

Each sector combination was allocated a code from 1 to 10 to reflect possible sector combinations:

Nexus combination	Code
No nexus	1
EW	2
EF	3
WF	4
EW/EF	5
EW/WF	6
EF/WF	7
EW, EF, WF	8
EWF	9
EWF + any other sector combination	10

The duration of ministers serving and duration of government departments were mapped according to the timeline and for each year in each jurisdiction, a code was allocated to reflect the integration at the time. After each year was allocated a code, these were summed to then reflect a total count of 'nexus years', where integration was evident, further broken down into the number of years per nexus or sector combination.

The possible combination of responsibilities are indicated in the left hand column. The blue and yellow shade boxes highlight which political party served for a greater amount of years with cross-sectoral responsibilities with the blue colour indicating when Non-Labor parties served for greater years and with the red colour indicating when Labor parties served for greater years.

Note: **EWF +** *indicates years when in addition to EWF combined responsibilities of a minister or department, another minister or department had cross-sectoral responsibilities of another possible combination.* **EWF *** *is the sum of* **EWF** *and* **EWF +**.

The analysis was derived data sources listed in Appendix D.

Table I1. Commonwealth

ALL PERIODS						
COM	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	118	77	41	118	77	41
% Nexus years	69%	71%	66%	70%	73%	66%
Total Nexus	82	55	27	83	56	27
EW	42	32	10	45	32	13
EF	6	2	4	0	0	0
WF	12	12	0	12	12	0
EW,EF	10	6	4	15	9	6
EW,WF	0	0	0	0	0	0
EF,WF	1	1	0	1	1	0
EW,EF,WF	0	0	0	0	0	0
EWF	11	2	9	10	2	8
EWF +	0	0	0	0	0	0
EWF *	**11**	**2**	**9**	**10**	**2**	**8**
% EWF years	**9%**	**3%**	**22%**	**8%**	**3%**	**20%**

PERIOD 1						
COM	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power						
% Nexus years						
Total Nexus	0	0	0	0	0	0
EW	0	0	0	0	0	0
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

PERIOD 2						
COM	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	38	27	11	38	27	11
% Nexus years	18%	26%	0%	18%	26%	0%
Total Nexus	7	7	0	7	7	0
EW	3	3	0	2	2	0
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	4	4	0	5	5	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

PERIOD 3						
COM	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	31	23	8	31	23	8
% Nexus years	94%	91%	100%	90%	96%	75%
Total Nexus	29	21	8	28	22	6
EW	19	19	0	20	20	0
EF	4	0	4	0	0	0
WF	0	0	0	0	0	0
EW,EF	6	2	4	8	2	6
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

PERIOD 3						
COM	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	31	23	8	31	23	8
% Nexus years	94%	91%	100%	90%	96%	75%
Total Nexus	29	21	8	28	22	6
EW	19	19	0	20	20	0
EF	4	0	4	0	0	0
WF	0	0	0	0	0	0
EW,EF	6	2	4	8	2	6
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

PERIOD 4						
COM	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	30	14	16	30	14	16
% Nexus years	100%	100%	100%	100%	100%	100%
Total Nexus	30	14	16	30	14	16
EW	17	10	7	18	10	8
EF	0	0	0	0	0	0
WF	2	2	0	2	2	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	11	2	9	10	2	8
EWF +	0	0	0	0	0	0
EWF *	**11**	**2**	**9**	**10**	**2**	**8**
% EWF years	**37%**	**14%**	**56%**	**33%**	**14%**	**50%**

PERIOD 5						
COM	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	19	13	6	19	13	6
% Nexus years	84%	100%	50%	95%	100%	83%
Total Nexus	16	13	3	18	13	5
EW	3	0	3	5	0	5
EF	2	2	0	0	0	0
WF	10	10	0	10	10	0
EW,EF	0	0	0	2	2	0
EW,WF	0	0	0	0	0	0
EF,WF	1	1	0	1	1	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

Table I2. New South Wales

ALL PERIODS						
NSW	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	163	100	63	163	100	63
% Nexus years	69%	55%	90%	71%	61%	86%
Total Nexus	112	55	57	115	61	54
EW	69	30	39	65	27	38
EF	23	17	6	18	18	0
WF	4	3	1	2	1	1
EW,EF	3	2	1	5	0	5
EW,WF	7	3	4	0	0	0
EF,WF	4	0	4	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	6	6	0
EWF +	2	0	2	19	9	10
EWF *	2	0	2	25	15	10
% EWF years	1%	0%	3%	15%	15%	16%

PERIOD 1						
NSW	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	45	45		45	45	0
% Nexus years	24%	24%		22%	22%	
Total Nexus	11	11	0	10	10	0
EW	0	0	0	0	0	0
EF	11	11	0	10	10	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 2						
NSW	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	38	27	11	38	27	11
% Nexus years	71%	78%	55%	76%	85%	55%
Total Nexus	27	21	6	29	23	6
EW	19	14	5	19	14	5
EF	6	6	0	8	8	0
WF	2	1	1	2	1	1
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 3						
NSW	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	31	7	24	31	7	24
% Nexus years	100%	100%	100%	100%	100%	100%
Total Nexus	31	7	24	31	7	24
EW	27	7	20	31	7	24
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	1	0	1	0	0	0
EW,WF	3	0	3	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 4						
NSW	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	30	13	17	30	13	17
% Nexus years	97%	92%	100%	87%	100%	76%
Total Nexus	29	12	17	26	13	13
EW	20	9	11	11	6	5
EF	2	0	2	0	0	0
WF	2	1	1	0	0	0
EW,EF	2	2	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	3	0	3	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	15	7	8
EWF *	0	0	0	15	7	8
% EWF years	0%	0%	0%	50%	54%	47%

PERIOD 5						
NSW	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	19	8	11	19	8	11
% Nexus years	74%	50%	91%	100%	100%	100%
Total Nexus	14	4	10	19	8	11
EW	3	0	3	4	0	4
EF	4	0	4	0	0	0
WF	2	2	0	0	0	0
EW,EF	0	0	0	5	0	5
EW,WF	2	2	0	0	0	0
EF,WF	1	0	1	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	6	6	0
EWF +	2	0	2	4	2	2
EWF *	2	0	2	10	8	2
% EWF years	11%	0%	18%	53%	100%	18%

Table I3. Victoria

ALL PERIODS						
VIC	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	163	127	36	163	127	36
% Nexus years	71%	71%	69%	75%	69%	94%
Total Nexus	115	90	25	122	88	34
EW	71	52	19	95	76	19
EF	6	6	0	15	3	12
WF	3	3	0	2	2	0
EW,EF	0	0	0	0	0	0
EW,WF	19	16	3	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	7	5	2	8	5	3
EWF +	9	8	1	2	2	0
EWF *	16	13	3	10	7	3
% EWF years	10%	10%	8%	6%	6%	8%

PERIOD 1						
VIC	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	45	45	0	45	45	0
% Nexus years	33%	33%		13%	13%	
Total Nexus	15	15	0	6	6	0
EW	9	9	0	6	6	0
EF	3	3	0	0	0	0
WF	1	1	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	2	2	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 2						
VIC	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	38	32	6	38	32	6
% Nexus years	92%	91%	100%	100%	100%	100%
Total Nexus	35	29	6	38	32	6
EW	18	13	5	38	32	6
EF	0	0	0	0	0	0
WF	2	2	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	11	10	1	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	4	4	0	0	0	0
EWF *	4	4	0	0	0	0
% EWF years	11%	13%	0%	0%	0%	0%

PERIOD 3						
VIC	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	31	26	5	31	26	5
% Nexus years	100%	100%	100%	100%	100%	100%
Total Nexus	31	26	5	31	26	5
EW	17	17	0	31	26	5
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	2	0	2	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	7	5	2	0	0	0
EWF +	5	4	1	0	0	0
EWF *	12	9	3	0	0	0
% EWF years	39%	35%	60%	0%	0%	0%

PERIOD 4						
VIC	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	30	19	11	30	19	11
% Nexus years	80%	79%	82%	93%	100%	82%
Total Nexus	24	15	9	28	19	9
EW	21	12	9	20	12	8
EF	3	3	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	6	5	1
EWF +	0	0	0	2	2	0
EWF *	0	0	0	8	7	1
% EWF years	0%	0%	0%	27%	37%	9%

PERIOD 5						
VIC	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	19	5	14	19	5	14
% Nexus years	53%	100%	36%	100%	100%	100%
Total Nexus	10	5	5	19	5	14
EW	6	1	5	0	0	0
EF	0	0	0	15	3	12
WF	0	0	0	2	2	0
EW,EF	0	0	0	0	0	0
EW,WF	4	4	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	2	0	2
EWF +	0	0	0	0	0	0
EWF *	0	0	0	2	0	2
% EWF years	0%	0%	0%	11%	0%	14%

Table I4. Queensland

ALL PERIODS						
QLD	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	160	95	65	160	95	65
% Nexus years	41%	25%	65%	28%	6%	58%
Total Nexus	66	24	42	44	6	38
EW	16	3	13	15	3	12
EF	2	2	0	0	0	0
WF	36	7	29	26	3	23
EW,EF	0	0	0	0	0	0
EW,WF	12	12	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	3	0	3
EWF +	0	0	0	0	0	0
EWF *	0	0	0	3	0	3
% EWF years	0%	0%	0%	2%	0%	5%

PERIOD 1						
QLD	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	42	40	2	42	40	2
% Nexus years						
Total Nexus	0	0	0	0	0	0
EW	0	0	0	0	0	0
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 2						
QLD	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	38	17	21	38	17	21
% Nexus years	18%	0%	33%	18%	0%	33%
Total Nexus	7	0	7	7	0	7
EW	0	0	0	0	0	0
EF	0	0	0	0	0	0
WF	7	0	7	7	0	7
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 3						
QLD	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	31	13	18	31	13	18
% Nexus years	94%	100%	89%	23%	0%	39%
Total Nexus	29	13	16	7	0	7
EW	0	0	0	0	0	0
EF	0	0	0	0	0	0
WF	22	6	16	7	0	7
EW,EF	0	0	0	0	0	0
EW,WF	7	7	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 4						
QLD	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	30	22	8	30	22	8
% Nexus years	47%	36%	75%	37%	14%	100%
Total Nexus	14	8	6	11	3	8
EW	0	0	0	0	0	0
EF	2	2	0	0	0	0
WF	7	1	6	11	3	8
EW,EF	0	0	0	0	0	0
EW,WF	5	5	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 5						
QLD	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	19	3	16	19	3	16
% Nexus years	84%	100%	81%	100%	100%	100%
Total Nexus	16	3	13	19	3	16
EW	16	3	13	15	3	12
EF	0	0	0	0	0	0
WF	0	0	0	1	0	1
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	3	0	3
EWF +	0	0	0	0	0	0
EWF *	0	0	0	3	0	3
% EWF years	0%	0%	0%	16%	0%	19%

Table I5. South Australia

ALL PERIODS						
SA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	144	90	54	144	90	54
% Nexus years	59%	60%	57%	74%	62%	93%
Total Nexus	85	54	31	106	56	50
EW	11	2	9	0	0	0
EF	1	1	0	5	3	2
WF	61	42	19	84	50	34
EW,EF	1	1	0	5	1	4
EW,WF	4	4	0	0	0	0
EF,WF	2	2	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	4	2	2	12	2	10
EWF +	1	0	1	0	0	0
EWF *	**5**	**2**	**3**	**12**	**2**	**10**
% EWF years	**3%**	**2%**	**6%**	**8%**	**2%**	**19%**

PERIOD 1						
SA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	26	26	0	26	26	0
% Nexus years						
Total Nexus	0	0	0	0	0	0
EW	0	0	0	0	0	0
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

PERIOD 2						
SA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	38	23	15	38	23	15
% Nexus years	71%	78%	60%	82%	83%	80%
Total Nexus	27	18	9	31	19	12
EW	2	1	1	0	0	0
EF	0	0	0	0	0	0
WF	17	10	7	31	19	12
EW,EF	0	0	0	0	0	0
EW,WF	4	4	0	0	0	0
EF,WF	1	1	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	2	2	0	0	0	0
EWF +	1	0	1	0	0	0
EWF *	**3**	**2**	**1**	**0**	**0**	**0**
% EWF years	**8%**	**9%**	**7%**	**0%**	**0%**	**0%**

PERIOD 3						
SA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	31	28	3	31	28	3
% Nexus years	100%	100%	100%	100%	100%	100%
Total Nexus	31	28	3	31	28	3
EW	0	0	0	0	0	0
EF	0	0	0	0	0	0
WF	31	28	3	31	28	3
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

PERIOD 4						
SA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	30	10	20	30	10	20
% Nexus years	50%	60%	45%	83%	60%	95%
Total Nexus	15	6	9	25	6	19
EW	0	0	0	0	0	0
EF	1	1	0	3	3	0
WF	13	4	9	22	3	19
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	1	1	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

PERIOD 5						
SA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	19	3	16	19	3	16
% Nexus years	63%	67%	63%	100%	100%	100%
Total Nexus	12	2	10	19	3	16
EW	9	1	8	0	0	0
EF	0	0	0	2	0	2
WF	0	0	0	0	0	0
EW,EF	1	1	0	5	1	4
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	2	0	2	12	2	10
EWF +	0	0	0	0	0	0
EWF *	**2**	**0**	**2**	**12**	**2**	**10**
% EWF years	**11%**	**0%**	**13%**	**63%**	**67%**	**63%**

Table I6. Tasmania

ALL PERIODS						
TAS	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	163	92	71	163	92	71
% Nexus years	34%	25%	46%	57%	30%	92%
Total Nexus	56	23	33	93	28	65
EW	22	7	15	66	17	49
EF	7	6	1	0	0	0
WF	14	9	5	23	7	16
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	12	0	12	4	4	0
EWF +	1	1	0	0	0	0
EWF *	**13**	**1**	**12**	**4**	**4**	**0**
% EWF years	**8%**	**1%**	**17%**	**2%**	**4%**	**0%**

PERIOD 1						
TAS	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	45	45	0	45	45	0
% Nexus years						
Total Nexus	0	0	0	0	0	0
EW	0	0	0	0	0	0
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

PERIOD 2						
TAS	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	38	26	12	38	26	12
% Nexus years	29%	19%	50%	66%	54%	92%
Total Nexus	11	5	6	25	14	11
EW	9	4	5	25	14	11
EF	1	0	1	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	1	1	0	0	0	0
EWF *	**1**	**1**	**0**	**0**	**0**	**0**
% EWF years	**3%**	**4%**	**0%**	**0%**	**0%**	**0%**

PERIOD 3						
TAS	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	31	1	30	31	1	30
% Nexus years	29%	100%	27%	100%	100%	100%
Total Nexus	9	1	8	31	1	30
EW	5	1	4	31	1	30
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	4	0	4	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**4**	**0**	**4**	**0**	**0**	**0**
% EWF years	**13%**	**0%**	**13%**	**0%**	**0%**	**0%**

PERIOD 4						
TAS	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	30	15	15	30	15	15
% Nexus years	70%	80%	60%	60%	53%	67%
Total Nexus	21	12	9	18	8	10
EW	8	2	6	10	2	8
EF	6	6	0	0	0	0
WF	7	4	3	4	2	2
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	4	4	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**4**	**4**	**0**
% EWF years	**0%**	**0%**	**0%**	**13%**	**27%**	**0%**

PERIOD 5						
TAS	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	19	5	14	19	5	14
% Nexus years	79%	100%	71%	100%	100%	100%
Total Nexus	15	5	10	19	5	14
EW	0	0	0	0	0	0
EF	0	0	0	0	0	0
WF	7	5	2	19	5	14
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	8	0	8	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**8**	**0**	**8**	**0**	**0**	**0**
% EWF years	**42%**	**0%**	**57%**	**0%**	**0%**	**0%**

Table I7. Western Australia

ALL PERIODS						
WA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	129	74	55	129	74	55
% Nexus years	23%	14%	36%	24%	23%	25%
Total Nexus	30	10	20	31	17	14
EW	4	0	4	0	0	0
EF	17	10	7	0	0	0
WF	9	0	9	31	17	14
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 1						
WA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	11	11	0	11	11	0
% Nexus years						
Total Nexus	0	0	0	0	0	0
EW	0	0	0	0	0	0
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 2						
WA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	38	19	19	38	19	19
% Nexus years	21%	0%	42%	0%	0%	0%
Total Nexus	8	0	8	0	0	0
EW	2	0	2	0	0	0
EF	3	0	3	0	0	0
WF	3	0	3	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 3						
WA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	31	17	14	31	17	14
% Nexus years	42%	53%	29%	100%	100%	100%
Total Nexus	13	9	4	31	17	14
EW	0	0	0	0	0	0
EF	13	9	4	0	0	0
WF	0	0	0	31	17	14
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 4						
WA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	30	17	13	30	17	13
% Nexus years	20%	6%	38%	0%	0%	0%
Total Nexus	6	1	5	0	0	0
EW	1	0	1	0	0	0
EF	1	1	0	0	0	0
WF	4	0	4	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

PERIOD 5						
WA	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	19	10	9	19	10	9
% Nexus years	16%	0%	33%	0%	0%	0%
Total Nexus	3	0	3	0	0	0
EW	1	0	1	0	0	0
EF	0	0	0	0	0	0
WF	2	0	2	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	0	0	0	0	0	0
% EWF years	0%	0%	0%	0%	0%	0%

Table I8. Northern Territory

NT	ALL PERIODS					
	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	45	31	14	45	31	14
% Nexus years	71%	58%	100%	24%	13%	50%
Total Nexus	32	18	14	11	4	7
EW	7	6	1	1	1	0
EF	4	2	2	2	0	2
WF	6	6	0	2	0	2
EW,EF	9	0	9	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	6	3	3
EW,EF,WF	1	0	1	0	0	0
EWF	4	3	1	0	0	0
EWF +	1	1	0	0	0	0
EWF *	**5**	**4**	**1**	**0**	**0**	**0**
% EWF years	**11%**	**13%**	**7%**	**0%**	**0%**	**0%**

NT	PERIOD 4					
	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	26	26	0	26	26	0
% Nexus years	50%	50%		4%	4%	
Total Nexus	13	13	0	1	1	0
EW	5	5	0	1	1	0
EF	2	2	0	0	0	0
WF	6	6	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	0	0	0	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**0**	**0**	**0**	**0**	**0**	**0**
% EWF years	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

NT	PERIOD 5					
	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	19	5	14	19	5	14
% Nexus years	100%	100%	100%	53%	60%	50%
Total Nexus	19	5	14	10	3	7
EW	2	1	1	0	0	0
EF	2	0	2	2	0	2
WF	0	0	0	2	0	2
EW,EF	9	0	9	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	6	3	3
EW,EF,WF	1	0	1	0	0	0
EWF	4	3	1	0	0	0
EWF +	1	1	0	0	0	0
EWF *	**5**	**4**	**1**	**0**	**0**	**0**
% EWF years	**26%**	**80%**	**7%**	**0%**	**0%**	**0%**

Table I8. Australian Capital Territory

ACT	ALL PERIODS					
	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	30	7	23	30	7	23
% Nexus years	97%	100%	96%	63%	14%	78%
Total Nexus	29	7	22	19	1	18
EW	19	6	13	18	1	17
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	2	0	2	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	4	1	3	1	0	1
EWF +	4	0	4	0	0	0
EWF *	**8**	**1**	**7**	**1**	**0**	**1**
% EWF years	**27%**	**14%**	**30%**	**3%**	**0%**	**4%**

ACT	PERIOD 4					
	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	11	6	5	11	6	5
% Nexus years	100%	100%	100%	0%	0%	0%
Total Nexus	11	6	5	0	0	0
EW	9	5	4	0	0	0
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	0	0	0	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	2	1	1	0	0	0
EWF +	0	0	0	0	0	0
EWF *	**2**	**1**	**1**	**0**	**0**	**0**
% EWF years	**18%**	**17%**	**20%**	**0%**	**0%**	**0%**

ACT	PERIOD 5					
	Port. & Min			Gov. Dept.		
	Total	NonALP	ALP	Total	NonALP	ALP
Years in power	19	1	18	19	1	18
% Nexus years	95%	100%	94%	100%	100%	100%
Total Nexus	18	1	17	19	1	18
EW	10	1	9	18	1	17
EF	0	0	0	0	0	0
WF	0	0	0	0	0	0
EW,EF	0	0	0	0	0	0
EW,WF	2	0	2	0	0	0
EF,WF	0	0	0	0	0	0
EW,EF,WF	0	0	0	0	0	0
EWF	2	0	2	1	0	1
EWF +	4	0	4	0	0	0
EWF *	**6**	**0**	**6**	**1**	**0**	**1**
% EWF years	**32%**	**0%**	**33%**	**5%**	**0%**	**6%**

Appendix J. EWF Policies

Appendix I provides details regarding EWF policies to support discussion in Chapter 8. EWF policies from 1970 to the present at Commonwealth and state levels are described. Only recent state policies have been included because of availability.

J1. Commonwealth policy

EWF sectors have been subject to broader economic reforms as well as environmental objectives, which during the 1970s began to receive greater attention. The reforms carried out in each of the EWF sectors reflected the role that each sector had in contributing to economic growth and development while the principles of the *National Strategy for Ecologically Sustainable Development (NSESD)* reflected the need to incorporate ecological consideration into policy. The intertwining of multiple objectives and higher-level cross-sectoral policy (economic and environmental policy) further add complexity to EWF policymaking.

Since the 1970s, there has been an increasingly national approach to EWF matters. With the establishment of the Council of Australian Governments in the 1990s, there have been greater opportunities for cooperative and coordinative policymaking between the tiers of government and across the states. The implementation of the *National Competition Policy (NCP)* is one such example of greater coordination.

EWF policies (1970 to 1999)

Energy

From the 1970s, the focus on energy policy has seen several shifts. In the 1970s, oil security concerns prompted national energy policy to address the country's dependency on liquid fuels. The pricing of oil, conservation of energy and inter-fuel substitution towards coal and gas sought to improve self-sufficiency (McHugh 1981). In the late 1980s, the government (Hawke Labor government) developed the country's first comprehensive energy policy statement to outline the government's energy policy towards the millennium. The scope of the policy was broader than that of the 1970s as it not only focussed on oil security but instead the country's overall energy security. It neither pursued self-sufficiency but instead sought to achieve a reasonable level of security within costs that would be acceptable to the community. Its three objectives were energy security, development of exports and greater efficiency in the domestic energy sector. The policy described future directions shaped by improvements in the country's export capabilities and

improvements in the domestic sector and was developed as a long-term policy rather than a policy to address immediate issues such as oil security.

The objectives pursued by the government throughout the rest of the period remained mostly unchanged. During the 1980s and the 1990s, the third objectives (greater efficiency) was of key importance, achieved through electricity and gas sector reforms (corporatisation, privatisation, deregulation and industry restructuring. These reforms contributed to the wider economic and neoliberalist agenda that sought to lessen the presence of government, which had characterised years of development in the sector. One of the major developments during this period included the National Electricity Market connecting NSW, Victoria, SA and eventually Queensland and Tasmania.

The *National Energy Management* (1990) document by the Minister of Resources listed objectives focussing on using energy efficiency (at lowest cost), identifying and adopting efficient and cost-effective technology, improving profitability and competitiveness, energy cost savings through '…reduced energy use and indirectly through reduced or deferred calls on public funds…' moreover, reducing environmental impacts (Griffiths 1990, p. 2). According to the following document in 1992, the emphasis was on national energy policy to improve national welfare.

In the 1990s, energy policy saw the greater incorporation of environmental considerations, particularly with the release of the *National Strategy for Ecologically Sustainable Development (NSESD)* and *National Greenhouse Response Strategy (NGRS)* in 1992 and the *National Greenhouse Strategy* in 1998. Both strategies detailed specific measures for the energy sector with a focus on reducing greenhouse gas emissions and recognising of environmental impacts of energy production.

In the mid-1990s, two energy policy papers were published, the *National Sustainable Energy Policy Discussion Paper* (1995) and the *Sustainable Energy Policy for Australia Green Paper* (1996) (this, however, did not lead to a Sustainable Energy White Paper). The *National Sustainable Energy Policy* recognised the importance of both NSESD and the NGRS. Its' guiding principles emphasised the integration of economic, environmental and social and equity considerations, including the energy sector's contribution to growth and international competitiveness. The *Sustainable Energy Policy for Australia* Green Paper (1996) presented a strategic framework based on six themes: market forces, energy efficiency, investment, the international community, mitigating risk and strengthening institutions. The NSESD however, was not mentioned. Environmental objectives were part of the efficiency objective. The objectives of energy policy increasingly reflected both economic reform agenda and to an extent environmental objectives. The challenges of dealing with greenhouse gas emissions, however,

became evident in 1997 with the rejection of the Kyoto protocol by former Prime Minister Howard's in the policy statement 'Safeguarding our future' which outlined an alternative strategy for Australia to reduce greenhouse gas emissions.

Water

The focus of water policies during the period sought to address several water issues. These included the impacts of water exploitation and overuse, rising environmental problems (salinity, erosion, pollution) and water quality problems which in turn were impacting on rural industries, who were the main users and consumers of water. Inadequate investment into water infrastructure coupled with years of environmental neglect by industry caused serious water issues. In 1975, during the Whitlam government, the Australian Water Resources Council released a statement comprising of ten policy goals; the provision of adequate water to meet both community and industry needs, sensible water resource development, water recycling, water pricing, pollution abatement, environmental protection (of aquatic environments and wetland), public education and community involvement. This was one of the first national water policy statements to be released in the country. Subsequent Commonwealth government policy statements followed in 1979 and then in 1984 responding to the *Water 2000* report which was developed in a similar fashion to the *Energy 2000* report. Such statements emphasised inter-related water and land management and financial and economic policies.

Table J1 provides a snapshot of major water policy statements of the 1970s and 1980s, detailing the objectives of each water policy. Each emphasises the availability of water.

Table J1. Water Policy Statements in the 1970s and 1980s

Policy Statement	Australian Water Resources Council Water Policy Statement1	Commonwealth Water Policy2	Commonwealth Water Policy3
Year	• 1975	• 1979	• 1984
Government	• Labor – Whitlam Government	• Liberal – Fraser	• Labor - Hawke
Objectives	• Provision of water supplies, adequate in quantity and quality, to meet the needs of people and to stimulate industry, compatible with projected market outlooks and with the resources and characteristics of the region concerned; • Development and management of water resources for flood mitigation, power generation, recreation and	• Ensure that water resource difficulties do not constrain national development; • Minimise losses and disruption caused by floods; • Encourage management practices which reverse trends in the deterioration of water quality and associated land resources; • Encourage a comprehensive approach	• Availability of water, adequate in quantity for all beneficial uses • Adoption of measures which improve the efficiency of water supply and use • Development of a comprehensive approach to inter-related water and land management issues • Encouragement of comprehensive long-term plans for the development

	wildlife conservation are achieved • Development of waste water treatment facilities and the encouragement of recycling and re-use • Adoption of water pricing policies to provide fair and reasonable prices and an incentive to all water users to avoid wasteful and environmentally harmful practices • Development of policies and practices aimed at achieving appropriate water quality objectives and pollution abatement; • Adoption of principle that direct costs, such as those attributable to pollution, should be borne by the polluter. • Zoning of flood-prone land • Maintenance of aquatic environments and preservation of wetlands for the benefit of native wildlife; • Implementation of programs to educate the public on factors affecting water resources development and use and for giving a sense of responsibility • Encouragement of interest and involvement of the community in the planning and management of water resources	to water/land planning and management; • Encourage the efficient use of water resources; • Encourage the development of financial and cost allocation policies appropriate to changing economic circumstances and community values; and, • Encourage public awareness and involvement in water resource issues •	and management of water resources, • Implementation of financial and economic policies which distribute the costs of water supplies equitably and provide incentives for the more economic use of resources at government and individual level.

Sources: 1. ABS Year Book Australia (No. 61, 1975-1976, p. 868), 2. ABS Year Book Australia (1980, p. 392)*, 3. Commonwealth of Australia (1984) response to 'Water 2000' report**

In the late 1980s, after years of River Murray management, the Murray-Darling Basin became a central feature of water policy upon the recognition that the entire basin needed to be managed to address ongoing water problems. In 1992, the Murray-Darling Basin Agreement was signed 'to promote and co-ordinate effective planning and management for the equitable efficient and sustainable use of the water, land and other environmental resources of the Murray-Darling Basin' (Murray Darling Basin Agreement, 2006, p. 8). In 1995, the Murray-Darling Basin Ministerial Council introduced the Murray-Darling Basin Cap on Surface Water Diversions (the Cap), introducing limits on the amount of water to be withdrawn and then paving the way for the

development of a market for water trading. The MDB was an important area of water governance and as it affected multiple states, required an increasingly inter-jurisdictional approach.

The NSESD was relevant to water policy as it specified objectives for water resources management with an emphasis on integration management between surface and groundwater resources and for balancing economic and social needs with ecological needs.

In 1994, the *National Water Quality Management Strategy* (NWQMS) was released with the objective of improving water quality both in Australia and New Zealand. This strategy was also informed by the ESD principles. The overall objective of the NWGMS strategy was *'to achieve sustainable use of the nations' water resources by protecting and enhancing their quality while maintaining economic and social development'* (ANZEC & ARMCANZ 1994a, p. 4). Under the NWQMS, Guidelines for Groundwater Protection were developed in 1995. Same principles for water protection and consideration of economic, social and environmental sustainability were also applied.

While the overall policy was developed at the Commonwealth level, implementation took place at the state level guided by the National Water Quality guidelines. Other important strategies aimed to redress water and environmental concerns included the *National Dryland Salinity Program* from 1993.

In 1994, the COAG implemented its Water Reform Framework to address water-related issues 'to halt the degradation of water resources and improve efficiency and sustainability in the water industry'. The Water Reform Framework focussed on a number of areas including pricing, property rights, allocation of water to the environment, water trading, public consultation, education, taxation, research and institutional reform (associated with administrative arrangements, decision-making processes, integrated catchment management, separation of resource management, standard setting and regulatory enforcement and service provision roles, service delivery efficiency).

The outcomes sought to be achieved by water policy increasingly reflected the need to consider environmental considerations of water use. The approach to redressing water issues reflected a market approach, promoting the need for pricing, property rights, allocation and trading.

Food

Food-related policies from the 1970s were largely associated with the reforms of the agricultural sector and the development of national food standards. Agricultural reforms were characterised by the phase-out of protectionist measures including farming assistance, a reduction of statutory marketing arrangements including the corporatisation of the many statutory boards for a number

of rural products and the emphasis on structural adjustment schemes to assist farmers in either exiting or remaining the industry.

An industry focus of agricultural policy was seen in the 1980's with the governments' *Economic and Rural Policy* which emphasised the link between rural industry and economic growth and the reinforcing relationship of one on the other. The policy sought to address the 'depressed situation' of the rural economy at the time characterised by declining farm price (Commonwealth of Australia 1986, p. 1). It focussed on several themes; broad level economic policy targeting lower inflation and enhancing competition, industry policy, reducing on-farm and off-farm costs and encouraging rural efficiencies, demand for specific commodities and welfare problems (Commonwealth of Australia 1986). In the same year, a policy approach for the reform of statutory marketing authorities was developed.

By the 1990s, industry performance and international competitiveness became the priority of the sector seen in, *Agri-Food Strategy* (1992) and the *Advancing Australia* package (1997). The first, emphasising export market development, efficiency improvements, and innovation and the latter, targeting farmers, ensuring the welfare of farmers as they undergo farm adjustment, providing them with a safety net and development (economic and social) in rural areas (Australian National Audit Office [ANAO] 2003). Much of the focus on sectoral growth and competitiveness has remained throughout the period.

Considerations of EWF linkages

Cabinet ministries reflected some integration of energy and water responsibilities, with the Hawke and Keating governments' reflecting the integration of all three EWF responsibilities

During the Fraser Liberal government, the Australian Water Resources Council, in 1975, issued its policy statement on water. The statement made some mentions related to energy and food. The policy statement in its ten policy principles encouraged the development of water resources and the use and consumption of water with respect to a number of considerations. Firstly, water supply security was reflected in the first objective that stated that 'the provision of water supplies, adequate in quantity, to meet the needs of people' (ABS 1976, p. 868). Secondly, it acknowledged the role of water for growth in terms of meeting 'the needs of, or to stimulate primary and secondary industry' (ABS 1976, p. 868). However, it also considered the need for such to be compatible with the market but also 'compatible with the resources and characteristics of the region concerned' (ABS 1976, p. 868) implying impacts with other resources and consideration of the environment. In its second goal for the development and management of water resources, it acknowledged power generation as a purpose of water amongst others, with the use of water subject to the first goal. Water and energy linkages were acknowledged. The principles promoted what appeared to be a responsible and sensible use of water considering environmental impacts

and the need for education and community involvement. It covered recycling in the context of wastewater, the adoption of fair and reasonable prices as an incentive to avoid wasteful and environmentally harmful practices. It considered water quality and loss of amenity from the pollution of water which it further stated are costs to be borne by polluters, as well as other direct costs. It also acknowledged the maintenance of undisturbed aquatic environments and preservation of wetlands, highlighting environmental aspects of water use.

The subsequent Commonwealth water policies (1979 and 1984) however were simplified, narrow in scope and not as detailed as the policy statement that was provided by the Australian Water Resources Council. Both focused on the need to provide water to achieve growth and the need for efficient water use, particularly in irrigated agriculture. They also emphasised the importance of water and land management highlighting essential linkages between both water and land resources acknowledging both the impact of land use on water (e.g. run-off) and the impact of water management on the quality and productivity of land and causing salinity in water and salinisation of land. Unlike the Council's statement, there was no direct references to power generation, only irrigation agriculture.

Given the strong links between water and agriculture in the context of Australia, it was not surprising that water policies had an emphasis on agricultural themes such as irrigation and rural water supply. For example, the water resources assistance programs often targeted water resource development for agricultural purposes. The Murray Darling Agreement (1992) and the COAG Water Reform (1994) were important water sector policies dealing with agricultural water use.

Conversely, rural and agricultural policies often emphasised water themes. For example in the government's *Economic and Rural Policy Statement* (1986), reference was made to the importance of water resources and other natural resources such as soil. Water resources development programs were part of a broader agenda to sustain rural industries which in turn were to contribute to the country's overall growth and development. A similar reference to the importance of water resources for enhancing rural activity was seen in the Labor government's *Primary Industry and Rural Policy* (1987).

References to energy in rural policies, however, were less salient than water. However reference to energy and in particular interlinkages with water and food were evident in the policy document *Policies for Growth in Primary Industries* (1988). Such a policy document was developed by the Department of Primary Industries and Energy which had cross-sectoral responsibilities across EWF. In its discussion of research activities, it described how interrelationships exist. For example how 'energy research affects farm cost structures and water' and how 'soil and forestry research impact on land degradation issues'. It furthermore promoted an integrated approach to research policies.

In the 1990s, three important cross-sectoral policies included the National Strategy for Ecologically Sustainable Development (NSESD) (1992), the National Greenhouse Response Strategy (NGRS) (1992) and the National Competition Policy (NCP) (1995). While not exclusive to one sector, these policies applied to all EWF sectors. They provided common objectives in which each sector could contribute, first to Ecological Sustainable Development, second to greenhouse reductions emission (which currently is framed as Climate Change and focusses more on energy sector) and thirdly to greater competitiveness of the economy.

Out of the three policies, the NSESD promoted the need for an integrated approach to development that considered economic, social and environmental aspects where ultimate goal was to achieve 'development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends' (Ecologically Sustainable Development Steering Committee 1992). Its first guiding principle was that 'decision-making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations'. Components of the strategy were targeted specifically at agriculture, mining and energy use, energy production and transport, amongst other sectoral issues and water resource management as an inter-sectoral issue. In the component for agriculture, the strategy emphasised the need for sustainable use of Australia's land and water to improve the long-term profitability of agriculture' hence acknowledging linkages between water and agriculture. It further detailed the government's commitment to 'improve integration of the agricultural and natural resource policy management responsibilities of Ministerial councils'. While not especially promoting the nexus between EWF, the strategy itself presented opportunities for more interconnected policymaking. The concept of Ecological Sustainable Development became an important feature in subsequent policies, and it also provided a means for which policies considered their impacts on other sectors. For example, in considering the goal of ecologically sustainable development, the *Food and Nutrition Policy* (released in 1992) had acknowledged in the policy the sectors use of water and fossil fuels and the need for the Food system to '*maintain the quality and integrity of the environment'*. It promoted its contribution to ecologically sustainable development by improving manufacturing methods in relation to its energy use.

The *National Water Quality Management Strategy* also focussed on ecologically sustainable development as a key principle of the strategy and furthermore an integrated approach to water quality management (ANZEC & ARMCANZ 1994b). The strategy acknowledged agricultural water use and industry water-use including hydro-electric power generation, food and beverage industry and the petroleum industry, stating the need to reduce impacts of agriculture and such industries on water quality for example agricultural run-off. The impacts of certain industries on water were also described in the *Guidelines for Groundwater Protection* (1995). It had noted energy generation, town gas sites, agriculture and agribusiness, mining, and mineral industries

and the food processing industry as sources of Groundwater contamination. The *Salinity and Drainage Strategy* (1999) was another policy in place to protect water quality also for agricultural uses.

Energy and food linkage references were less dominant. The only reference was found in the *Safeguarding Our Future: Australia's Response to Climate Change* statement by Prime Minister Howard who described the linkage between emissions and the exporting industries such as agriculture, implying negative consequences on emissions reduction for the agricultural sector and also potentially undermining Australia's responsibility to provide food from its industries (Howard 1997).

Of the many policies that were released during the period from the 1970s to end of the 1990s, those described above were the only policies have referenced linkages between EWF. Other important policies including the national energy policies (those mentioned in the Australian Energy Policy Review, the Energy 2000 National Energy Policy Paper, National Energy Management strategies) were mostly siloed with only references to aspects of the sector and no mention of water and food sectors, neither mention of water as an input to energy or impacts on water and agricultural sectors. Other agricultural strategies such as the *Agri-Food Strategy* (1992) and the *Advancing Australia* package (1997) both focussing on the competitiveness and growth of the agricultural sector neither had references to water or energy, particularly in terms of the role water sectors and energy sectors play in facilitating competitiveness and growth.

EWF policies (2000 to the present)

EWF-related policies over the last eighteen years continued to show commitment to economic reform as economic growth remained a key priority. Ecologically Sustainable Development, however, became less of a priority, with fewer mentions in policy documents during this period. Policies to redress Climate Change (previously targeted at greenhouse gas emissions) became an important area of debate during this period.

Energy

Energy policy after the start of the new millennium continued to focus on further market development and reform. The *National Energy Policy Framework* (2001) put forward by the COAG had three main objectives based on encouraging, firstly, the efficient provision of reliable, competitively-priced energy services to Australians, secondly, responsible development of energy resources, efficient use and export (although not clear what responsible means, perhaps in the context of sustainable development) and thirdly, mitigation of local and global environmental impacts associated with all stages of the supply chain from production to use (Ministerial Council of Energy 2001).

Emphasis was on market development particularly given the establishment of the National Electricity Market. In 2004, the Australian Energy Market Agreement was signed by all states and Territories, agreeing to further reforms underpinned by the objective to promote 'the long-term interests of consumers with regard to the price quality and reliability of electricity and gas services' (Australian Energy Market Agreement, 2004, p. 6). The framework was to support energy market governance and investment, improve economic regulation, improve planning and development of electricity transmission networks, enhance demand-side management and retail competition, increase the penetration of natural gas and reduce greenhouse gas emissions. In 2012, a further set of reforms were introduced by the Standing Council on Energy Resources. These were based on four key themes included, network regulation, consumers, competition and innovation and network investment.

During the period three policy white papers were released by the three different governments, first in 2004 from the Howard Liberal government, the second in 2012 from the Gillard Labor government and shortly after in 2015 by the Abbot Liberal government. Table IJ2 compares the three Energy White Papers.

Table J2. Energy White Papers from 2000 to the present

Energy White Paper	**2004 Securing Australia's Energy Future**	**2012 Australia's Energy Transformation**	**2015 Energy White Paper**
Government	Howard Liberal Government	Gillard Labor Government	Abbot Liberal Government
Government Department	Department of Prime Minister and Cabinet	Department of Resources, Energy and Tourism	Department of Industry, Innovation and Science
Objective	'To ensure that Australians have reliable access to competitively priced energy, the value of energy resources is optimised, and environmental issues are well managed.' (Pg. 2)	'…building a secure, resilient and efficient national energy system that… provides accessible, reliable and competitively priced energy and energy services for all Australians, enhances Australia's domestic and export growth potential and delivers clean and sustainable energy'. (Pg. 5)	'Competitively priced and reliable energy supply to households, business and international markets through: Competition that will improve customer choice and put downward pressure on prices The more productive use of energy to lower costs, improve energy use and stimulate economic growth Investment to encourage innovation and energy resources development to grow jobs and exports' (Pg. 2)
Policy Focus	Energy Resources Energy Markets Energy Efficiency Energy Security Energy and Climate Change Relationships Energy and Environment Relationships Innovation	Energy Security Energy Resources Clean Energy Energy Markets Energy Productivity	Competition Energy Productivity Investment

Relevant Energy-related policy	Australian Energy Market Agreement 2004	National Strategy on Energy Efficiency 2009 Clean Energy Future Plan 2012	National Productivity Plan 2015 Industry Growth Sector Initiative 2016

The policy papers were similar in objectives, particularly in their priorities for 'competitively priced energy' and the means for further reforms in the sectors supported by both parties. All policies emphasized energy exports and the importance of innovation in the industry. Both Howard and Gillard energy policy papers highlighted the importance of energy security which was not present in the latest Abbot policy paper. The attention given to Climate Change policy was also less apparent in the most recent paper with brief reference to the governments Direct Action Plan, a subsidy-based emissions reduction policy and alternative to the Labor government's carbon pricing policy. In contrast, Climate Change was a large component of the Gillard government policy with a separate policy for clean energy, the policy paper *Securing a Clean Energy Future*. Sustainability and environmental considerations, however, appeared to be more of a priority of the preceding governments. No new energy white paper has been released by the government.

In 2017, in response to energy security concerns of the National Electricity Market, an independent review on its future security was undertaken, led by the country's Chief Scientist. The review was developed as a 'blueprint' proposing a number of recommendations for the government to address security issues in the sector. The main outcomes envisaged in the blueprint were centred on increased security, future reliability, rewarding consumers and lower emissions. While important, the reviews' main focus was on electricity, particularly the National Electricity Market for which, to some extent does not apply to WA and the Northern Territory. It does not provide a long-term policy for the entire energy sector addressed entirely at the National Level.

In the same year, the government released a policy factsheet titled 'Powering Forward – A better energy future for Australia', the most recent document detailing the governments' long-term energy policy. It focussed on three key areas of affordability, reliability and emissions as ultimate objectives of the government, highlighting the need to better integrate energy and climate policy. Several actions discussed included; the National Energy Guarantee (NEG) (to address reliability and emissions reduction with impacts on lowering energy bills), an Energy Security Obligation, the Australian Domestic Gas Security Mechanism, the Gas Supply Commitment from industry, carbon capture and storage and the expansion of the Snowy Mountains Scheme project, 'Snowy 2.0'. Following recommendations by the Finkel Review, the government also established the Energy Security Board.

After recent failure to implement the reliability and emissions targeted NEG and change in leadership in August 2018, energy policy remains unclear, particularly regarding climate change policy. While the primary concern is lowering prices, there has been no new energy policy proposal.

Water

The importance of a national approach to water policy rose during this period was reflected in the introduction of the *National Water Initiative* (NWI) (2004) to further water sector reforms and the inter-jurisdictional governance of the MDB.

The NWI reflected the continued emphasis on water reforms built upon the reforms of the COAG Water Reform Framework, ten years prior which aimed to address the degradation of the country's water resources. The NWI sought to achieve a number of outcomes focussing on secure water access entitlements, statutory-based water planning, statutory based provision for environmental and public benefit outcomes, environmentally sustainable levels of extraction, water trading, water accounting, water use efficiency and innovation and integrated management of surface and groundwater resources. Table J3 details the key elements and outcomes of the NWI.

Table I3. Intergovernmental Agreement on a National Water Initiative – Key Elements and Outcomes

KEY ELEMENTS	OUTCOMES
Water Access Entitlements and Planning Framework **Water Access Entitlements Environmental and Other Public Benefit Outcomes** **Water Planning Addressing Currently Overallocated and/or Overused Systems** **Assigning Risks for Changes in Allocation** **Indigenous Access** **Interception**	Parties agree that, once initiated, their water access entitlements and planning frameworks will: • enhance the security and commercial certainty of water access entitlements by clearly specifying the statutory nature of those entitlements • provide a statutory basis for environmental and other public benefit outcomes in surface and groundwater systems to protect water sources and their dependent ecosystems • be characterised by planning processes in which there is adequate opportunity for productive, environmental and other public benefit considerations to be identified and considered in an open and transparent way • provide for adaptive management of surface and groundwater systems in order to meet productive, environmental and other public benefit outcomes • implement firm pathways and open processes for returning previously overallocated and/or overdrawn surface and groundwater systems to environmentally-sustainable levels of extraction • clearly assign the risks arising from future changes to the consumptive pool • in the case of water access entitlements, be compatible across jurisdictions to improve investment certainty, be competitively neutral and to minimise transaction costs on water trades (where relevant) • reflect regional differences in the variability of water supply and the state of knowledge underpinning regional allocation decisions • recognise indigenous needs in relation to water access and management • identify and acknowledge surface and groundwater systems of high conservation value, and manage these systems to protect and enhance those values

	• protect the integrity of water access entitlements from unregulated growth in interception through land-use change
Water Markets and Trading	States and Territories agree that their water market and trading arrangements will: • facilitate the operation of efficient water markets, and the opportunities for trading, within and between States and Territories, where water systems are physically shared or hydrologic connections and water supply considerations will permit water trading • minimise transaction costs on water trades, including through good information flows in the market and compatible entitlement, registry, regulatory and other arrangements across jurisdictions • enable the appropriate mix of water products to develop based on access entitlements which can be traded either in whole or in part, and either temporarily or permanently, or through lease arrangements or other trading options that may evolve over time • recognise and protect the needs of the environment • provide appropriate protection of third-party interests
Best Practice Water Pricing **Water Storage and Delivery Pricing** **Cost Recovery for Planning and Management** **Investment in new or refurbished infrastructure** **Release of unallocated water** **Environmental Externalities** **Institutional Reform**	• Parties agree to implement water pricing and institutional arrangements which: • promote economically efficient and sustainable use of a) water resources; b) water infrastructure assets; and c) government resources devoted to the management of water • ensure sufficient revenue streams to allow efficient delivery of the required services • facilitate the efficient functioning of water markets, including inter-jurisdictional water markets, and in both rural and urban settings • give effect to the principles of user-pays and achieve pricing transparency in respect of water storage and delivery in irrigation systems and cost recovery for water planning and management • avoid perverse or unintended pricing outcomes • provide appropriate mechanisms for the release of unallocated water
Integrated Management of Water for Environmental and Other Public Benefit Outcomes	Parties agree that the outcome for integrated management of environmental water is to identify within water resource planning frameworks the environmental and other public benefit outcomes sought for water systems and to develop and implement management practices and institutional arrangements that will achieve those outcomes by: • identifying the desired environmental and other public benefit outcomes with as much specificity as possible • establishing and equipping accountable environmental water managers with the necessary authority and resources to provide sufficient water at the right times and places to achieve the environmental and other public benefit outcomes, including across State/Territory boundaries where relevant • optimising the cost-effectiveness of measures to provide water for these outcomes
Water Resource Accounting **Benchmarking of Accounting Systems** **Consolidated Water Accounts** **Environmental Water Accounting Information** **Metering and Measuring** **Reporting**	Parties agree that the outcome of water resource accounting is to ensure that adequate measurement, monitoring and reporting systems are in place in all jurisdictions, to support public and investor confidence in the amount of water being traded, extracted for consumptive use, and recovered and managed for environmental and other public benefit outcomes.
Urban Water Reform **Demand Management**	Parties agree that the outcome for urban water reform is to: • provide healthy, safe and reliable water supplies • increase water use efficiency in domestic and commercial settings

Innovation and Capacity Building to Create Water Sensitive Australian Cities	• encourage the re-use and recycling of wastewater where cost-effective • facilitate water trading between and within the urban and rural sectors • encourage innovation in water supply sourcing, treatment, storage and discharge • achieve improved pricing for metropolitan water
Community Partnerships and Adjustment	Parties agree that the outcome is to engage water users and other stakeholders in achieving the objectives of this Agreement by: • improving certainty and building confidence in reform processes • transparency in decision making; and • ensuring sound information is available to all sectors at key decision points Parties also agree to address adjustment issues raised by the implementation of this Agreement
Knowledge and Capacity Building	Parties agree that the outcome of knowledge and capacity building will assist in underpinning implementation of this Agreement

Source: Intergovernmental Agreement on a National Water Initiative (2004)

The initiative required states to develop their own plans for implementing the NWI and for water sharing between each state's water users. The Natural Resource Management Ministerial Council (NRMMC), at the time and the National Water Commission (NWC) established in 2004 were responsible for overseeing the implementation and the progress of the NWI. In 2014, following the introduction of the Liberal government, the Commission was abolished in 2014, with its responsibilities transferred to the Productivity Commission.

The Murray-Darling Basin continued to be a key feature of water policy, during the period, with the ultimate aim of remedying years of misuse of the water resources in the basin through improved governance and management by Commonwealth and the states. This was seen in a number of inter-governmental agreements including; the Inter-governmental Agreement on Addressing Water Over-Allocation and Achieving Environmental Objectives in the Murray Darling Basin in 2004; the Agreement on Murray-Darling Basin Reform in 2008; the Murray-Darling Basin Plan in 2012 and the 2013, the Inter-governmental Agreement on Implementing Water Reform in the Murray Darling Basin.

The series of agreements have reflected increased recognition of the need to properly address water use in the basin, with concerns regarding both economic and environmental viability of the water use. The need to meet both urban demands, particularly of the major cities supplied by the basin and rural demands, particularly of agricultural industries made improved basin management an imperative.

In 2008, responsibilities shifted from being predominately of the states to the Commonwealth, who through organisations like the Murray Darling Authority was vested with the responsibility for governing the basin, to be supported by a partnership between Commonwealth and state governments. The authority was to be responsible for developing a plan, to be known as the 'Basin Plan' to better manage water use. Since 1995, limits on water withdrawals in the MDB have been

in place through the Murray-Darling Basin Cap on Surface Water Diversions. As part of the Basin Plan, the process for limiting water is transitioning towards sustainable diversion limits, involving a limit to both surface and groundwater diversions to ensure sustainable limits of water extractions in the Basin. In 2012, the Basin Plan was passed through Parliament. Acknowledgement of water for critical human needs was also to influence the way in which water was to be managed. In 2013, the Intergovernmental Agreement on Implementing Water Reform in the Murray-Darling Basin was signed supporting the implementation of the plan. The objective of intergovernmental agreement, as stated was 'to ensure that the Commonwealth led Basin water reforms, including the Basin Plan, are implemented in a cost-effective manner to support the national interest of improving river and wetland health, putting water use on a sustainable footing, enhancing irrigation productivity, providing water for critical human needs, and providing farmers and communities with more confidence to plan for a future with less water'. Greater attention of water policy has been on prioritising the health of the country's water assets and ensuring a balance between the economic and social use of water and the environment.

To support the changes in water governance, particularly in the MDB and in new responsibilities, the *Water Act of 2007* was enacted, becoming one of the most important developments in water policymaking during this period and the first overarching piece of water legislation passed by the Commonwealth. In the same year, the government introduced the *National Plan for Water Security (2007),* comprising of $10 billion worth of funding to implement measures to address water security issues during the millennium drought. In 2010, the Labor governments' water program, *Water for the Future*, was implemented building upon the objectives of the previous government. The program emphasised the Basin Plan, buybacks of water entitlements for the environment as part of the *Restoring the Balance program* and investment in efficient irrigation systems. Table J4 lists the programs key priorities to prepare for a future with less water.

Table J4. Water for the Future (2010)

KEY PRIORITIES	
Taking action on climate change	• Development of a Basin Plan to establish sustainable water diversion limits in the MDB • Better monitoring, assessment and forecasting of the availability, condition and use of water resources • Helping farmers and rural communities plan for climate change impacts on water availability • Assessing current and future water availability in the MDB, Tasmania, south-west WA and northern Australia through CSIRO Sustainable Yields projects • Investigation of northern Australia's water resources development
Using water wisely	• Investment for; efficiency and productivity of on-farm irrigation water use and management; modernisation plans for their districts, irrigation infrastructure upgrades (including private irrigation infrastructure operators) • Reforming the water market to establish cooperative, efficient and effective planning and management arrangements

	• Installations of rainwater tanks and greywater systems to save potable water supplies • Water Efficiency Labelling and Standards (WELS) Scheme (save water and money for households)
Securing water supplies	• Local government support in the MDB to assist in community-wide planning and invest in water savings initiatives • Investing in desalination, water recycling and stormwater harvesting and reuse projects reducing reliance on rainfall • Funding practical projects that save water and reduce water losses in towns and cities across Australia
Supporting healthy rivers	• Setting a sustainable level of water that can be taken out of rivers and groundwater systems in the MDB, and preparing an Environmental Watering Plan for the Basin • Purchasing water entitlements which can be used for the environment • Allocating Commonwealth water to the environmental assets that most need to be protected or restored

***Source**: Department of Sustainability, Environment, Water, Population and Communities (2010)*

In 2016, the Liberal government released the *National Groundwater Strategic Framework*. During the period, other water-related programs were implemented including those targeted towards environmental issues such as salinity and erosion.

The development of water policy has reflected a bipartisan approach to water policy of which both government parties have supported common goals for improved water governance across the country.

Food

Food-related policy during the period has continued to centre on industry growth, export growth and agricultural competitiveness and the sector continued on its path for further reforms and liberalisation. By the late 1990s, rural adjustment schemes were terminated, and many of the protectionist measures were removed (Industry Commission (IC) 1998, p. 14).

Policies focussed on industry performance and on enhancing the industries global position. This was seen early in the period in the National Food Industry Strategy in 2002. The vision of the strategy was that *'the Australian food industry would be a significant global player with a sustainable and profitable role in the global food product system'.* The next food policy was in 2013, *National Food Plan,* developed by the Gillard Labor government, focussing on the four themes, exports, industry, sustainability and people (access, affordability, and contributing to the food security of other countries).

Recent food policies have reflected a greater emphasis on industry growth and performance than on food security as the country has had fewer concerns regarding its food supply in recent times, given that it is a large food exporter with a food supply estimated to feed 60 million, more than double the current population (Department of Agriculture & Forestry 2013). The emphasis on

industry competitiveness is reinforced in the Liberal government's latest food sector related policy document, Australia's Agricultural Competitiveness White Paper, released in 2015. Table J5 shows the two latest food-related policies by both governments, both of which have an industry focus. Furthermore, the governments Industry Growth Centre Initiative further demonstrates an industry emphasis on the agricultural sector to contribute to growth. Table J5 compares the two food and agricultural policies.

Table J5. Food and Agriculture policy

Policy	National Food Plan	Agricultural Competitiveness White Paper
Government	Labor – Gillard Government	Liberal – Abbot Government
Year	2013	2015
Themes	• Growing exports - emphasising being an export-focused food producer, taking advantage of growth in Asia and removing trade barriers • Thriving industry – promoting competitiveness and productivity, investment in research capacity, infrastructure biosecurity and workforce, ensuring right amount of regulation • Sustainable food – managing natural resources • People – ensuring and maintaining food security both domestically by 'improving access to safe and nutritious food particularly for those living in remote communities or struggling with disadvantage' and globally by contributing to helping farmers in developing countries gain access to new agricultural technologies and sharing expertise	• A fairer go for farm businesses – creating stronger business environments with better regulation, healthier market competition, more competitive supply chains and improved tax systems • Building the infrastructure of the 21st century – water, transport and communications infrastructure to support efficient movement of produce, access to suppliers and markets and production growth • Strengthening our approach to drought and risk management • Farming smarter – strong research and development systems for productivity growth as well as effective natural resource policy that achieves a cleaner environment as part of a stronger Australia • Accessing premium markets – accessing export markets

In addition, the development of food regulations through intergovernmental cooperation between Australia and New Zealand, to ensure safety and quality of food was another feature of food policy. More recently, attention has been placed on minimising food wastage, through the *National Food Waste Strategy*, targeting both industry and households to minimise food wastage.

Consideration of EWF linkages

Howard Liberal Government (2000-2007)

The policies developed by the Howard Liberal government after 2000, were developed during a period of partial integration between water and food responsibilities with a Minister of Agriculture, Fisheries and Forestry responsible for both water and food-related matters. The Minister of Industry Science and Resources followed by the Minister for Industry, Tourism and Resources was responsible for energy matters. Corresponding departments supported these ministers. In 2007, changes to Machinery of Government resulted in the separation of water and

food, with the creation of the portfolio for Environment and Water and the corresponding Minister for Environment and Water Resources. The Department of Environment and Water Resources was also created in this year taking over the water responsibilities previously with the Department of Prime Minister and Cabinet. This reflected the importance of water issues at the time during the Millennium Drought. In the final year of the former Prime Minister's term in 2007, EWF responsibilities were separated from each other.

The Howard government after the year 2000 was responsible for a number of important EWF policies. Energy policies and other energy developments included the COAG's *National Energy Policy* in 2001, the introduction of the Mandatory Renewable Energy Target in the same year and the 2004 *Energy White Paper*. Further energy reforms were implemented, and the Australian Energy Market Agreement was signed. The government was responsible for the National Water Initiative in 2004 which continues to serve as the blueprint for water reforms, and in the same year, the Inter-governmental Agreement on addressing water over-allocation and achieving environmental objectives in the Murray Darling Basin was signed. The government also implemented the *National Plan for Water Security*, the Prime Minister's response to the worsening water situation at the time. Other programs also included the *National Action Plan for Salinity and Water Quality* in 2000 and the *Living Murray Program*. The Howard government also implemented the *National Food Industry Strategy* in 2002.

Only a few of these policies however reflected considerations to related sectors. The *National Water Initiative* (2004), described earlier recognised the access and use of water for a variety of purposes, including, irrigation, industrial use and mining hence with an understanding of EWF linkages through water use.

One of the outcomes sought was the implementation of water access entitlements and planning frameworks to better manage water across a variety of uses. While no specific mention was given to farming users (although assumed), specific mention was given to mineral and petroleum sectors in relation to the need for other policies and measures beyond the agreement to plan for and manage water use and water-related impacts by those sectors (Council of Australian Government 2004, p. 6, para. 34). It was acknowledged that such sectors faced special circumstances *(discussed in the following chapters)* which required further action beyond that mentioned in the NWI. No mention, however, was given in terms of water planning to other energy-related users such as those in power generation. No other mention to energy was given in in the document. The only inter-sectoral references made were in relation to irrigation, seen throughout the document. While water and food continue to be linked, the way water policy treats the agriculture sector, and the mining and extractive industries sector indicates inconsistency in the conditions for which both sectors use water.

In the governments' *Energy White Paper* (2004), water and food only received minor mentions. Water was mentioned in the context of the environmental impacts of energy production and use where such can reduce water quality for example through salinity impacts. Agriculture was mentioned in terms of the sector being one of the largest greenhouse gas emitters. There was no mention of water or food as part of the policy actions.

Unsurprising for a water policy, the *National Plan for Water Security* (2007) reflected food linkages with its emphasis on irrigation infrastructure as a key component for improving water security through the water use efficiency. There was no mention of energy-related aspects.

Other policies during the term, however, made no mention of the other-related sectors. Energy-related reforms were concerned with energy market development and made no reference to impacts on water or food. Policies during the Howard government showed a lack of integration between EWF policies. The disconnect between energy and water and food was consistent with the integration of portfolio and ministerial responsibilities where water and food responsibilities were joined while energy remained a separate responsibility. The linkages between water and food were important, particularly during times of drought where the management of water by agricultural users was a means for dealing with water security issues.

Rudd and Gillard Labor Governments (2007-2013)

In 2007, Labor government returned to power under Prime Minister Rudd, whose new cabinet comprised of separate ministers, a Minister for Resources and Energy responsible for energy, a Minister for Agriculture, Fisheries and Forestry responsible for food matters and a Minister responsible for Climate Change and Water. In 2010, the Minister for Climate Change and Water was replaced by the Minister for Climate Change, Energy Efficiency and Water, responsible for both energy and water matters, combined under the new Rudd government. While there were corresponding government departments for Resource, Energy (and tourism) and Agriculture, Fisheries and Forestry, there were separate departments for Environment, Water, Heritage and the Arts, and for Climate Change.

The Rudd government was responsible for fewer EWF policies. In energy, the government was responsible for the introduction of the first *National Energy Security Assessment* and the *National Strategy on Energy Efficiency*, both in 2009. In water, the IGA on Murray–Darling Basin Reform 2008, was signed and in the same year, states referred their powers over the MDB to the Commonwealth amending the *Water Act of 2007*. No food policies were developed or implemented during Rudd's first government.

Both COAG Work Program on Water and the Murray Darling Basin Agreement mentioned the importance of irrigation and agriculture. In the *National Strategy on Energy Efficiency*, the only

mention of water was in the context of efficiency requirements for hot water systems and in the mandatory disclosure of residential buildings of energy, greenhouse and water performance. Integration of EWF policies was mostly absent.

The National Energy Security Assessment (NESA) 2009, however, acknowledged the impact of water in influencing energy security, demonstrating that reduced water availability would likely affect the security of electricity supplies through reduced reliability and with negative impacts on affordability.

In 2010, a change in leadership in the Labor party, saw Julia Gillard as the new Prime Minister, remaining in government until 2013. Cabinet changes involved the separation of EWF responsibilities with separate ministers responsible for the portfolios: Resources and Energy; Agriculture, Fisheries and Forestry; Sustainability, Environment, Water, Population and Communities and Climate Change and Energy Efficiency followed by the Climate Change, Industry and Innovation. Each portfolio had a corresponding department, with two departments responsible for energy the Department of Resources, Energy and Tourism and the Department of Climate Change and Energy Efficiency.

During her term, former Prime Minister Gillard introduced policies in all EWF areas. In energy, in addition to further market reform implementation, the government developed the Energy White Paper *Australia's Energy Transformation* in 2012 and the Climate Change policy document *Securing a Clean Energy Future* detailing the government's response to Climate Change, involving the introduction of a carbon price. The government also followed up with the National Energy Security Assessment in 2011. In the same year, the government developed the *National Food Plan White Paper*, *Our Food Future*, one of the first policy documents to comprehensively address the food policy at the national level. In the same year, the *Murray Darling Basin Plan* was introduced in 2012. In 2010, the government released its *Water for the Future* policy. The Gillard government also developed a white paper detailing Australia's broader economic policy, under the Australia in the Asian Century Paper in 2012. The policies during this period despite separation in portfolios demonstrated integration and consideration of linkages.

The *Water for the Future* policy was largely targeted towards farmers, hence reflecting water and food linkages, particularly in the first two priorities, the first, taking action on climate change involving helping farmers and rural communities to plan for the impacts of climate change on water availability and the second, using water wisely, investing to improve efficiency and productivity of on-farm irrigation use management and irrigation moderation.

The NESA 2011, acknowledged the interdependencies between energy sectors and other sectors. It recognised the agriculture sector as one of the sectors to be impacted by changes in energy security. It also highlighted energy relationships with the water sector discussing the importance

of the NWI for better managing water enabling generators to secure water through markets and avoid 'being faced with the prospect of water restrictions as has previously occurred during drought conditions' (Department of Resources, Energy and Tourism [DRET] 2011). The assessment also described the possibilities of downward pressure on prices arising from reduced water availability (p. 87). Water was also discussed as a constraint for unconventional gas development.

The *Carbon Farming Initiative* (CFI) in 2012 demonstrated consideration of EWF linkages. The CFI allowed farmers and land managers to earn carbon credits by storing carbon or reducing greenhouse gas emissions on the land based on eligible activities. By providing a list of activities that could not be eligible for the CFI, excluding activities that may have negative impacts on land access for agricultural production, the availability of water, conservation of biodiversity, employment and the local community, the initiative was designed to avoid impacts on both water and food security.

The governments' *Energy White Paper* in 2012 referenced other related water and food sectors however in its discussion of factors determining energy security it neglected mention of interrelated securities of water security and food security. It highlighted the importance of water availability by acknowledging the potential of increased risks to energy security. A whole chapter of the policy document was dedicated to discussing sustainability, especially promoting the need for integrated energy and water policy, recognising the importance of water in electricity generation for hydro-electricity and in cooling coal or gas-fired thermal generation.

Other mentions of water and energy linkages were associated with the risks of investing in water-intensive technology, reduced water availability leading to higher wholesale prices as well as the need for the safe development of unconventional gas. Consideration to food impacts was also evident. These were related to the conflicts between mineral resource development and agriculture.

The *Clean Energy Future Plan* (2012), did not mention water but mentioned food-related aspects. Part of the plan included the *Clean Technology Food and Foundries Investment Program* involving the assistance to food and foundry manufacturing business (trade-exposed business) to invest in energy efficiency equipment and low-pollution technologies. It acknowledged the importance of the food and food manufacturing business to contribute to lower emissions. In the *National Food Plan Green Paper* (2012) and *White Paper* (2013), energy and water were discussed throughout with attention on the need to ensure energy and water for the food production and the role that energy and water play in meeting food goals**.** In 2013, the *National Harmonized Regulatory Framework for Natural Gas from Coal Seam Gas* discussed management

of agriculture, land and water, recognising the impacts of gas exploration on natural resources and hence with recognising the interlinkages between all three sectors.

The *Australia in the Asian Century* paper (2012) under the Department of Defence discussed Australia's place in the Asian continent. It highlighted the importance of interrelated challenges associated with EWF and stemming from the growth in the region and in the rising living standards of the population, the expanding middle class expected to raise demands for goods and services.

The policies of the former Prime Minister Gillard government demonstrated to a large extent consideration of the interrelationships between EWF, interestingly despite the separation of responsibilities at the portfolio, ministerial and department level. Although the Rudd government returned during the second half of 2013, no new EWF policies were implemented under the government.

Return of the Liberal Government: Abbot (2013-2015), Turnbull (2015-2018), Morrison (2018 to the present)

The Liberal government returned in 2013 and was comprised of separate relevant ministers; Minister for Industry followed by the Minister of Industry and Science both responsible for energy and with some responsibilities over related food manufacturing, Minister for Agriculture responsible for food and the Minister for Environment with responsibilities over water.

When the Abbot Government came into power, its first actions was to repeal the carbon price legislation of the previous Gillard government, introducing its alternative Climate Change Policy, the *Direct Action Plan* and the *Emissions Reductions Fund*. In 2015, the Abbot government released three policy papers, the *Domestic Gas Strategy*, the *Energy White Paper* and *the Agricultural Competitiveness White Paper*. No new water policies aside from that related to agricultural policies were introduced by the government.

The *Domestic Gas Strategy* (2015), took into account impacts of gas developments on water and agriculture sector, referring to the government's principles for the development of coal seam gas:

1. That access to agricultural land should only be done with the farmer's agreement, and farmers should be fairly compensated
2. that there must be no long-term damage to water resources used for agriculture and local communities;
3. That prime agricultural land and quality water resources must not be compromised for future generations (Department of Industry and Science [DIS] 2015a)

Similarly, in the Energy White Paper, 2015, mentions of water and agriculture were in the context of gas development and the need to achieve 'co-existence outcomes' associated with the need to protect agriculture and water resources. Part of the policy's actions was to invest in research to support sustainable gas development with respect to its impacts on agricultural land and water.

In the *Agricultural Competitiveness White Paper* (2015) water was a key element of both the second and third priorities, centred on building water infrastructure and managing risks of drought. Emphasis was on securing water supplies mostly through infrastructure developments. Energy aspects were also considered in terms of the energy intensity of such infrastructure and the potential for high energy costs.

In 2015, the Turnbull Government came into power. Ministers and portfolios had separate EWF responsibilities including the Minister for Industry, Innovation and Science, responsible for energy and food manufacturing industry matters, Minister for Resources, Energy and Northern Australia, Minister for Agriculture responsible for food and the Minister for the Environment responsible for water. In 2015, integration of water and food was seen when water was transferred to the Agricultural portfolio, and a new minister for Agriculture and Water Resources was created, combining both food and water responsibilities. In 2016, energy was transfer from the industry portfolio to be combined with the environmental portfolio.

Since in power, the Turnbull government was responsible for delivering the *National Energy Productivity Plan* (NEPP) (following from the previous Energy White Paper) (2015), the *National Groundwater Strategic Framework* (2016) and the *National Food Waste Strategy* (NFWS) (2018).

While no new Energy White Paper was developed most of the government's actions regarding energy has been in response to new developments in the sector. The NEPP (2015) had no mention of water and only mentioned agriculture to the extent of it as an industry for which energy cost savings could be made, showing how increased energy productivity could benefit the agricultural sector. After the failure of the NEG, new Prime Minister Morrison separated the portfolio with a separate Minister for Energy and a separate Minister for the Environment.

The Finkel Review in 2017, had little mention of EWF linkages. Water was mentioned in terms of hydropower and pumping storage (however there was no discussion on water impacts or water security impacts), critical water infrastructure to support the NEM, drought risks to the NEM, as well as coal seam gas developments, which also considered impacts on land and agriculture. Other mentions of food were in relation to food and agricultural waste as fuel such as biogas. In the governments, the latest policy factsheet, *Powering the Future*, energy and water linkages were evident in the government's proposal to extend the capacity of the Snowy Mountains Hydro-Electric Scheme.

In the NFWS (2018), reference to water and energy were in terms of wasted resources associated with food waste. It advocated that preventing food waste would hence prevent wastage of other resources such as water and energy and positive environmental outcomes could be achieved.

The Liberal policies from 2013 have shown to some extent consideration of EWF linkages. However, policies are still largely separate. In 2017, the Liberal government released its Foreign Policy White Paper discussing themes of ensuring national security and the need for Australia to be responsible for its security. Part of the policy highlights the importance of EWF security as one of the governments' priorities. Climate Change and demand for sustainable sources of EWF were described to be 'political, economic and security disrupters over the longer term (Department of Foreign Affairs and Trade [DFAT] 2017, p. 33). The paper acknowledges the nexus between EWF characterised by increasing water requirements for food and energy production leading to higher demands in energy needed to store and transport food. It notes Australia's role in responding to these challenges in the context of the country's involvement in the region, through involvement in research to inform improvements in food security, in providing development assistance to support energy access and trade and in further sharing expertise in water management for agricultural productivity (DFAT 2017). Despite the discussion, no integrated policy for EWF were developed.

Summary

From 1970 to the present, the Commonwealth government has been active in EWF areas. Energy policies have gone through several phases, from addressing oil security, developing a national energy approach, energy sector reforms involving corporatisation and privatisation of utilities and other government business, deregulation, industry restructuring, further market development, integration of energy policy and climate change policy and more recently energy security challenges associated with the reliability of the current electricity system, energy shortages particularly in gas, state-wide blackouts and rising energy prices. The approach to addressing energy issues has typically involved ongoing reform with a continued emphasis on competition, efficiency and productivity. As international competitiveness and enhancing Australia's position as an energy exporter (of mostly fossil) remains an important goal, implementing Climate Change to meet international commitments has been a challenge.

Water policy has evolved contrasting with those of the previous period, now with a key focus on the sustainable management of water and no longer driven by purely water resources development and growth interests. Rather than pursuing and consuming greater volumes of water, attention has been placed on adopting more sustainable ways for using and consuming water. This has involved placing limits on the volume of water that can be withdrawn and ensuring a level of water quality that is compatible with both social, industrial and environmental needs and has required

substantial changes in the way water is governed such as in pricing of water, operation of water markets and in the monitoring and collection of water information.

The changes that took place within food policy are such that the current settings now contrast with that of the previous periods also. From a heavily protected and assisted sector, the agricultural sector is now one that is the least supported. During the 1970s food policy was characterised by the phase-out of protectionist measures including farming assistance, a reduction of statutory marketing arrangements including the corporatisation of the many statutory boards for a number of rural products and the emphasis on structural adjustment schemes. By the 2000s, food policy focussed on further improving industry competitiveness, furthering the growth opportunities for the sector, both domestic and international.

J2. State Policies

The changes in EWF policies from the 1970s to the present are reflected by EWF reforms and in the various state policy documents.

EWF reforms

From the 1970s to the late 1990s, state policies were focussed on economic reform with significant variation in progress and approach across the states. For example, Victoria was the first state to fully privatise its electricity sector under the Liberal Greiner government while many other states opted for continued government control. This example reflected varied state progress not only because of differences in the states' industries but because of the opposition to reform (seen in NSW) (Roarty 1998).

Reforms in electricity and gas took place in all states while mining reforms took place in the NT, Queensland and NSW. In the 1980s, Queensland, NSW and Victoria took measures to reduce operating costs in the electricity sector. In the NT and ACT, electricity and water authorities were amalgamated. Electricity pricing reforms commenced in SA in 1987, followed by Victoria and NSW in 1989. In the 1990s, other states took measures to reduce operating costs and reform pricing. Commercialisation, corporatisation and industry restructuring took place during the period. In SA, Electricity Trust SA (ETSA) was commercialised in 1990 and in 1991, the State Electricity Commission of NSW was restructured. In 1992, Victoria commenced privatisation. Gas reforms took place from the late 1980s. These reforms involved deregulation, restructuring and the introduction of third-party access arrangements. Gas-related legislation in such as in Queensland, NSW, SA and ACT were amended to support increased competition and the provision of access to pipelines. Pricing reforms and industry restructuring also took place throughout the period (IC 1998).

State water reform commenced in the 1980s. However, measures to protect environmental water through limits on diversions was seen in SA as early as 1969 (IC 1998). State reforms involved reform to water rights, corporatisation and separation of functions by public utilities of which had policy, regulation and service provision responsibilities (NWC 2011b). In 1982, SA introduced temporary and permanent transferrable water entitlement schemes, followed by other similar schemes in WA, NSW, Queensland and Tasmania in the late 1980s and Victoria in 1990. Changes towards user pay-reforms occurred in the early 1980s, starting with NSW's Hunter Water Board. Pricing reforms commenced in SA, Victoria and NT in the early 1990s, followed by Queensland in 1993 and in Tasmania in 1995 (IC 1998). Agricultural reforms across the states involved changes to marketing and deregulation in various industries (e.g., egg, dairy and grain). The reforms in EWF differed accordingly to each sector. Pricing reforms, however, were common to both energy and water sectors as well as utility-related reforms.

EWF policies (late 1990s to the present)

Up until the present, EWF sectors have continued to play a key role in state development where EWF policies have often been part of broader state economic policies. Recent state economic plans have highlighted the importance of EWF in contributing to state objectives. Table J6 shows recent state economic plans. In addition to economic policy, some of the more recent state Climate Change policies have also highlighted the role of EWF sectors involving how sectors can contribute to lower emissions. Almost all states (except NT and WA) have set long-term targets for net zero emissions by 2050, with interim targets. Energy policy has been most relevant to Climate Change policy particularly for the uptake of renewable energy and energy efficiency as a means to reduce emissions.

Over the last couple of decades, almost all states have developed policies for EWF, highlighting the importance of each of the sectors in each state. Across all sector policies, Climate Change has been an important consideration. Renewable energies, conservation of water, efficiencies in both energy and water use as well in the use of land resources and the prevention of adverse environmental impacts are themes evident in all state policies.

Key priorities common to all state energy policies have included renewable energy or cleaner energy, energy efficiency, affordability and more recently energy security both in terms of reliability and affordability. Priorities have varied across the states. In NSW, Queensland and Victoria, states have separate energy efficiency and renewable energy plans. Tasmania, in its 2015 energy plan focussed on energy as the states' competitive advantage with its goals to achieve the lowest electricity prices in Australia and attract energy-intensive industries. SA's focus was on energy security following recent state-wide blackouts. State strategies have emphasised further investments in the development of new energy technologies both in renewable and clean energy,

to achieve greater efficiency and to enhance the renewable energy sector. Much of water policy is coordinated and driven at the Commonwealth level in line with the National Water Initiative (NWI) and the Basin Plan for relevant states. Under the NWI in 2004, each state was required to develop an implementation plan, covering a number of components from pricing, water rights, entitlements and trading, to safeguarding environmental water. The development of water resource sharing plans have also been required. Water policies are especially reflected in water legislation.

State water policy plans continue to emphasise the 'sustainable development' of water, consistent with water reforms, involving integrated management of water to account for both land and water resources, environmental impacts and protection of river health, and the security of water for human needs. Water efficiency and conservation have been key themes. Victoria's water policy framework differs from other states as it also provides a water framework for Traditional owners, highlighting the cultural significance of water. State food and agriculture policies have emphasised sector development and economic growth while incorporating 'sustainable development' and environmental considerations. Productivity and more efficient use of natural resources such as land and water have been key areas along with promoting food nutrition to improve health and food safety. With little concern for food security (food availability), most food and agricultural policies focus on achieving state economic growth. For example, SA's policy, *Premium Food and Wine from our Clean Environment* highlights the states desire to market its food and wine produce as produced from an environment that is well taken care of and able to produce quality food.

Table J6. State Economic Plans

STATE	YEAR	POLICY	VISION	OBJECTIVES	RELEVANCE TO EWF
VIC	2002	Growing Victoria Together - Innovate State. Caring Communities	By 2010 Victoria will be a State where: '- Innovation leads to thriving industries generating high quality jobs - Protecting the environment for future generations is built into everything we do - We have caring, safe communities in which opportunities are fairly shared - All Victorians have access to the highest quality health and education services all through their lives'	1. Providing decent and responsible government. 2. Getting the basics right – good schools, quality health care, more jobs, safe streets. 3. Leading the way to a better Victoria with education and lifelong learning as the key. Strategic Issues* 2. High quality, accessible health and community services 6. Promoting sustainable development 7. More jobs and thriving, innovative industries across Victoria 9. Protecting the environment for future generations 11. Government that listens and leads	Seeks to ensure sustainability of energy, mining and food production through job creation, reduction in greenhouse gasses, secure and reliable electricity and gas at affordable prices Energy sector strategies: establishment of the Sustainable Energy Authority, incentives for energy efficiency in houses and building projects, energy smart advisory centres, promotion of promotion of green power Agriculture sector strategies: funding to farmers to help farmers manage salinity, improve irrigation and plant more trees Priority actions to involve future development of renewable energy sources and improvements in productivity and sustainability of natural resource industries such as farming, fisheries and mining Priority action to ensure security of energy supply to achieve goal for more jobs and innovative industries Water management key to protecting the environment with emphasis on water catchment management, improving heath of rivers and water ways and reducing salinity
SA	2007	SA's Strategic Plan - Creating the future	'…commitment to making this state the best it can be – prosperous, environmentally rich, culturally stimulating, offering its citizens every opportunity to live well and succeed. ...We will achieve a better future for SA by keeping our communities strong, maintaining an international outlook, and promoting knowledge, inquiry and innovation. By	Six Objectives 1. Growing Prosperity 2. Improving Wellbeing 3. Attaining Sustainability 4. Fostering Creativity and Innovation 5. Building Communities 6. Expanding Opportunity	Energy, water and agriculture key components Specific strategies and actions in energy and water under the Attaining Sustainability objective Water targets: sustainable water supply, River Murray flows, River Murray salinity Energy targets: renewable energy, energy efficiency of government buildings and dwellings Mining part of the export targets Actions related to agriculture part of other objectives for soil protection

			aspiring to be the best, we can better secure a good quality of life for South Australians of all ages and backgrounds.'		
QLD	2008	Towards Q2: Tomorrows Queensland	'Strong: We want to create a diverse economy powered by bright ideas Green: We want to protect our lifestyle and environment Smart: We want to deliver world-class education and training Healthy: We want to make Queenslanders Australia's healthiest people Fair: We want to support a safe and caring community'	2020 Targets* 1. Queensland is Australia's strongest economy, with infrastructure that anticipates growth - Increase by 50 per cent the proportion of Queensland businesses undertaking research and development or innovation 2. Cut by one-third Queenslanders' carbon footprint with reduced car and electricity use - Protect 50 per cent more land for nature conservation and public recreation 4. Cut by one-third obesity, smoking, heavy drinking and unsafe sun exposure - Queensland will have the shortest public hospital waiting times in Australia	Government to invest in water and energy infrastructure Strategy to cut Queenslanders' carbon footprint by one third through reduced car and electricity use Strategy to reduce obesity by one-third
SA	2010	The 30-Year Plan for Greater Adelaide	'Maintaining and improving liveability Increasing competitiveness Driving sustainability, environmental protection and resilience to climate change'	Principles* 1. A compact and carbon efficient city 3. Accessibility 6. Social inclusion and fairness 7. Heritage and character and protection and enhancement 8. Healthy, safe and connected communities 9. Affordable living 10. Economic growth and competitiveness 11. Climate change resilience 12. Environmental protection restoration and enhancement 13. Natural resources management	Specific policies and targets for Primary Production, Mining and Resources, Water and Energy and targets (see Plan)
NSW	2011	NSW 2021	'A Plan to make NSW number one'	Five key priorities, 32 goals 1. Rebuild the economy 2. Return quality services 3. Renovate infrastructure	Goal 1. Improve the performance of the NSW Economy Target: Grow GSP per capita by an average of 1.5% per year to 2020 with specific industry growth targets. Action: New Frontiers program to attract petroleum and mineral exploration investment

			4. Strengthen our local environment and communities 5. Restore accountability to government	Goal 3. Drive Economic Growth in Regional NSW Target: Protect Strategic Agricultural land and improve agricultural productivity. Action: Finalise Aquifer Interference policy and regulation to provide guidance on acceptable mining impacts to protect water resources Goal 5. Place Downward Pressure on the cost of living Target: Contain electricity costs through efficiency energy use Goal 19. Invest in Critical Infrastructure Target: Increase expenditure on critical NSW Infrastructure (including water infrastructure. Goal 21. Secure potable water supplies Target: Secure long term potable water supplies for towns and cities supported by effective effluent management Goal 22. Protect our natural environment Target: Protect and restore priority land ,vegetation and water habitats Target: Increase Renewable Energy 20% renewable energy by 2020 Goal 28. Ensure NSW is ready to deal with major emergencies and natural disasters Target: Increase the number of floodplain risk management plans available to support emergency management planning Target: Maintain preparedness to deal with biosecurity threats
2014	State Planning Strategy 2050	'Sustained Growth and Prosperity - A diverse state; offering a diversity of ecosystems, landscapes, enterprises, people and cultures. - A liveable state; the place of choice for the brightest and best. - A connected state; as connected to the rest of the world as any other place.	Relevant Objectives 1.1. The Resources Economy - to maintain and grow WA as the destination of choice for responsible exploration and development of resources 1.4. Agriculture and food - To enable the State's food supply chains to meet he protected demands of its domestic and global food and fisheries market 1.6 Land Availability - To ensure the sustainable supply, use and development of land	Strategies to influence EWF part of achieving the states goal related to economic development and physical infrastructure. The first objective focusses on the resources economy, the agriculture and food sector and the second objective focusses on water and energy

			- A collaborative state; enabling alignments that progress the State's sustained growth and prosperity.'	2. Physical Infrastructure - To coordinate physical infrastructure with development for community betterment 2.2 Water - To support WA's growth and development by managing the availability and quality of water sustainably 2.3 Energy - To enable secure, reliable, competitive and clean energy that meets the State's growing demand	
TAS	2016	Jobs and Economic Plan Update	No stated vision	Targets* 'Jobs - to reduce the unemployment rate to at least the national average. Population - to increase our population to 650,000 by 2050. Agriculture - To grow the value of the agriculture sector to $10 billion by 2050. Aquaculture - Partner with the salmonid industry to sustainably develop a $1 billion per annum industry.'	Energy and agriculture are key components of the government's strategy Water is discussed in context of agriculture, fisheries and aquaculture
NT	2017	Our Economic Future - Increasing private sector investment to grow Territory jobs - Northern Territory Economic Development Framework	No stated vision	Framework for economic development Natural Resources People Capital Connectivity Enterprise and Innovation Liveability	Policy focusses to enhance sectors for growth with focus on agri-business and energy and minerals sectors Agri-business is considered a growth sector Renewable energy is considered a developing sector
QLD	2017	Advancing Trade and Investment	Positioning Queensland as Australia's most innovative and dynamic trading economy – a magnet for global investment.	Objective 1. Identify key opportunities 2. Facilitate export growth 3. Attract job-creating investment 4. Strengthen out regions	Policy targets mining and mining equipment, technology and services and food and agri-business both major export industries. Mention of biofuels and renewable energy

*relevant objectives/targets selected

There has been some indication of security of energy and water concerns, but the objective of ensuring the security of energy and water is also tied to the need for supporting industries in addition to supporting energy and water for human needs.

New South Wales

A number of the EWF policies have been developed and implemented since the late 1990s during the Carr Labor government to the present Berjiklian Liberal Government. The Carr government was responsible for the *State Groundwater Policy Framework* (1997) along with the *Groundwater Quality Protection Policy* (1998) and the *Water Conservation Strategy* (2000). It was also responsible for the *NSW Policy for Sustainable Agriculture* (1998). In 2002, the government implemented the *Greenhouse Gas Reduction Scheme*.

Despite integration at the ministerial and departmental level between water and energy the policies implemented by the Carr government only had some consideration of EWF linkages. Impacts on water (such as groundwater) from energy and agricultural sectors were recognised and considered in water policies, with emphasis particularly on agricultural sectors to improve water use efficiency. This was also seen in the governments' policy for Sustainable Agriculture (1998). Linkages between water and food and water and energy were given more attention than energy and food linkages.

The *State Groundwater Policy Framework* (1997) and the *Groundwater Quality Protection* (1998) were introduced with 'the goal to manage the state's groundwater resources so that they can sustain environmental, social and economic uses for the people of NSW' (Department of Land and Water Conservation [DLWC] 1997). Both documents referred to energy and food as part of their guiding principles. In the policy framework, this was seen in the eighth principle which stated that 'groundwater management should be integrated with the wider environmental and resource management framework, and also with other policies dealing with human activities and land use, such as urban development, agriculture, industry, mining, energy, transport and tourism' (DLWC 1997). The impacts of such uses on groundwater such as pollution needed to be managed collectively.

The *Water Conservation Strategy* (2000) sought to achieve 'greater efficiency in the use of water in a manner that recognises its true value, is economically viable and environmentally sustainable'. The strategy comprised of a number of principles and strategies. Linkages with food were dominant with agricultural water use as a key aspect of the policy, to ensure greater efficiency of water use particularly in irrigation. Mention of food aspects was associated with improvements in the monitoring of water for irrigation and the production of food and fibre. Minor references to energy were made in the context efficiency for both energy and water savings.

One of the actions was to promote a national water conservation rating and labelling system similar to energy labelling.

The *Policy for Sustainable Agriculture* (1998) sought 'to facilitate a change in agricultural production in NSW towards ecologically and economically sustainable practice and farming systems' (NSW Agriculture 1998). Water use and quality were discussed as key issues, measures, and strategies centred around improving agricultural management practices ensuring effective and efficient water use practices for all water users to conserve and protect the environment. No mention was given to energy-related aspects regarding the goal towards sustainable agriculture, neither discussing emissions.

The Liberal governments from 2011 introduced policies for EWF, under Premiers O'Farrell, Baird and Berejiklian. Cabinet ministries were characterised by the partial integration of ministerial responsibilities, combining of water and food.

The O'Farrell government was responsible for the NSW ten year plan '*NSW 2021 – A Plan to make NSW number one*' and for two energy plans the *Energy Efficiency Action Plan* and the *Renewable Energy Action Plan*, both in 2013. The *NSW 2021* plan covered policy in water, energy and food and agriculture areas contributing to the overall growth of the state. The plan comprised of five key priority areas with thirty-two goals.

Energy was covered in *Goal 5* which sought to place downward pressure on the cost of living and in the corresponding target, to contain electricity costs through efficient energy use, for more cost-effective energy-supply. *Goal 22*, to protect the natural environment had the corresponding target to increase renewable energy, targeting 20% renewable energy by 2020. The policy also stated that this would promote energy security through a diversified energy mix (NSW Department of Premier and Cabinet [NSW DPC] 2011).

Water was covered specifically in *Goal 21* to secure potable water supplies with its target to 'secure long-term potable water supplies for towns and cities supported by effective effluent management' (NSW DPC 2011, p. 41). This involved meeting reliability performance standards for water continuity and quality, water recycling and water conservation. Various other policies were to facilitate the achievement of this goal such as the Metropolitan Water Plan, the Country Towns Water Supply and Sewerage Program and the Water Sharing Plans. Achieving these goals was the responsibility of the Minister for Primary Industries. Water was also covered in *Goal 3* to 'drive economic growth in regional NSW' in the corresponding target to 'protect strategic agricultural land and improve agricultural productivity' also targeted at the agricultural sector. This was through the governments Aquifer Interference Policy and regulation, intended to provide guidance on mining impacts and the protection of water resources and through government research development and education programs to improve water efficiency as well as reduce

greenhouse gasses. Achieving this target required actions in both water and energy. Water was also covered in *Goal 5* of the plan, to achieve a 4-star National Australian Built Environment Rating System (NABERS) energy and water rating through building retrofit programs. Investment in water infrastructure was an action to achieve *Goal 19* which was to invest in critical infrastructure. Water was further mentioned in the target for *Goal 22* in the protection of water habitats.

As mentioned, agriculture was covered in *Goal 3* '…to drive economic growth in regional NSW' part of another target to 'protect strategic agricultural land and improve agricultural productivity, this involved strategic land use plans and improved productivity. The overall plan hence involved a number of goals and targets intersecting EWF areas. It also involved a number of different ministers with responsibilities over primary industries and the environment to be responsible for achieving goals.

The *Renewable Energy Action Plan* was introduced in 2013 and through its three goals, 'to attract renewable energy investment and projects, build community support for renewable energy and attract and grow expertise in renewable energy technology', sought to achieve the government's vision of 'a secure affordable and renewable energy future for NSW'. The plan, however, had minor references to water and food which were both in the context of renewable energy technologies. Water was mentioned in terms of solar hot water heating and in opportunities for hydro-electric generation for attracting renewable investment. Agriculture was mentioned in terms of the production of biofuels. Impacts on water and agriculture as a result of the plan, however, was not discussed or mentioned.

The *Energy Efficiency Action Plan*, also introduced in 2013, had the goal of reducing bills and pressure on future prices through energy efficiency. This was linked to the targets of the NSW 2021 plan. The plan detailed three actions across five areas, energy efficiency in markets, homes, businesses, and government and in state-wide delivery. In achieving efficiency, the plan, however, had minor references to water, quoting the target to achieve a four-star energy and water rating and in terms of improving water use efficiencies in government agencies. There were minor mentions of food, discussing the impact of rising energy costs in leading individuals to cut back on food, affecting health. The two energy action plans had minor references to water and food sectors.

The following Baird Liberal government was responsible for a number of policies in EWF, including the *NSW Gas Plan* (2015) (also proposing to develop an Advanced Energy Strategy), the *NSW Water Resource Plans Roadmap* (2016), *NSW Food Safety Strategy* (2015) and the Right to Farm Policy (2015).

The *Gas Plan* (2014) had five key priorities; 1) 'better science and information to deliver world's best practise regulation', 2) 'pause, reset and recommence – gas exploration', 3) 'strong and certain regulation', 4) sharing the benefits and 5) securing NSW gas supply needs. Both water and agriculture were covered in the plan. Water was mentioned in the context of the recognition of gas impacts, consistent with the concerns articulated in national policy. The protection of water resources was a key theme seen in the discussion of the prevention of coal seam gas activities in certain areas and the *Aquifer Interference Policy*, mentioned above, 'to protect aquifers and groundwater by setting objective criteria to assess the potential impact of all activities including gas activities on water,' and also in increasing scrutiny of new proposals that may affect water and agriculture.

The *Agriculture Industry Action Plan* (2014) focussed on achieving agricultural growth through productivity, enhancing the workforce and businesses. Energy and water were mentioned in the need for investing in critical infrastructure where secure access to water is a key to economic growth. In 2015, two food-related policies, the *Right to Farm Policy* and the *Food Safety Strategy*. The *Right to Farm Policy*, as the title suggests, concerns the right for farmers to farm 'without conflict or interference arising from complaints from neighbours and other land users'. The six priorities involved 1) reinforcing rights and responsibilities, 2) ongoing monitoring and evaluation of land use conflict, 3) strengthening land use planning, 4) ensuring ongoing reviews of relevant environmental planning instruments to include consideration of options to ensure best land use outcomes and to minimise conflicts, 5) improving education and awareness on management of land use conflicts and 6) considering potential future legislative option and whether additional government intervention is required (NSW Department of Primary Industries 2015). There was no mention of water or energy-related aspects associated with the policy. The government's vision for the *Food Safety Strategy* was 'Food safety, confidence and certainty across the supply chain', pursuing four outcomes including 1) safe food production and less foodborne illnesses, 2) certainty and confidence for consumers and all food operators, 3) innovative and productive food industries, and 4) globally competitive food businesses. Mentions of water were minor, mentioned briefly in terms of managing natural resources for sustainable agriculture and in terms of foodborne illnesses from non-chlorinated water (NSW Food Authority 2015). No mention was given to energy-related aspects. The last two food policies were hence siloed with very limited consideration of the energy and water linkages with food.

In 2016 and 2017, three water policies were introduced, the *NSW Water Resources Plans Roadmap* (2016) (introduced by the Baird government), the *Metropolitan Water Plan* (2017) and *Water Reform Action Plan* (2017), introduced by the following Berejiklian Liberal government.

The *Water Resources Plans Roadmap* (2016) was to assist in the implementation of the Commonwealth's Basin plan, particularly in relation to agricultural uses. Energy uses was subsumed under other consumptive purposes. The main goal of the *Metropolitan Water Plan* (2017) was 'securing water for a liveable, growing and resilient Greater Sydney' (NSW Metropolitan Water Directorate 2017, p. 1) pursuing four main outcomes of a 'secure and affordable' water supply, a 'resilient (to stresses and shocks) water supply system, liveable and resilient urban communities and healthy rivers downstream from dams. There were minor references to agriculture in relation to release of the Warragamba dam and recycled water for agriculture. There were also minor references to energy, through linkages between water-efficiency, reduction of energy use and reduction of energy bills. The *Water Reform Action Plan* (2017) stated four water goals: 1) introduce best practise for water management, 2) ensure transparency in how water is shared, allocated and managed, 3) build a compliance and enforcement regime that ensures strong and certain regulation and, 4) build capability to support implementation of water reform. Reference to farming was in the priority to enable farmers (as well as other water users) to achieve and improve water efficiency. It also mentioned the use of technology for water monitoring and compliance activities including remote sensing of on-farm water storages (NSW Department of Industry 2017, p. 3). There was no mention of energy-related aspects.

The *Climate Change Framework* (2016) had the aim of making NSW more resilient to a changing climate ensuring economic, social and environmental wellbeing. Its long-term objective was to 'achieve net-zero emissions by 2050' (NSW Office of Environment and Heritage 2016). Water and energy were both main features of the policy directions, 'to manage impacts on natural resources, ecosystems and communities', while energy was mentioned under the policy direction 'to boost energy productivity'. There was no specific mention of food aside from a minor reference to agriculture as a sector in which opportunities from net-zero emissions are to arise.

Victoria

Policies analysed for Victoria include mostly Labor policies as Liberal policies for EWF could not be sourced. Only one policy could be sourced prior to the of the current Andrews Labor government which was the *Renewable Energy Strategy* (1989) by the Cain Jnr Labor government. The policy had some mentions to agriculture and water referring to greater use renewables to reduce the loss of land for farming caused by brown coal extraction, production of biogas from agricultural wastes and water in terms of hydroelectric schemes.

Since 2015, the Andrew's Labor government has been responsible for a number of energy, water, food and Climate Change policies. While the policies appear separate, the policies are interrelated and are referenced as part of the overall plan for Victoria, particularly under its Climate Change

plan (2017). Water and food linkages are captured in both water and agricultural policies, *Water For Victoria Water Plan* (2016) and *Agriculture Victoria Strategy* (2017) with recognition of the importance of water management and water policy to achieve agricultural policy. The water policy listed specific actions to facilitate improved water management in the agricultural sector. Energy-related policies had minor references to water and food sectors, mentioning water only to the extent of solar hot water and water efficiencies. Climate Change policy made references to all sectors, acting as a broader framework for policies developed in each sector.

Queensland

EWF policies over the last ten years were sourced with no prior policy documents available. These policies included those by the Bligh Labor government the Newman Liberal government and the current Palaszczuk Labor government.

Unlike the previous states, water has been managed under the *Environmental Protection Water Policy of 2009* under the *Environmental Protection Act of 1994*, developed under the Bligh Labor government. Since then no new water policy for the state has been developed. The policy specifies environmental values (EV's), management goals and water quality objectives (WQC's) with the objective of protecting the state's water environment. The policy captures linkages between water and energy and water and food through its environmental values regarding irrigation, stock watering, aquaculture and industrial use including water for food beverage, petroleum and power industries, mining and minerals and processes.

Energy policies included the *Renewable Energy Plan* (2009), the *Energy Management Plan* (2011) by the Bligh Labor government and the most recent *Powering Queensland Plan* (2017) by the Palaszczuk Labor government. The *Renewable Energy Plan* was to support the government's commitment to a greenhouse has a target of 60% below 2000 levels by 2050, focusing on the deployment of renewable energy infrastructure (QLD Office of Clean Energy 2009). The *Energy Management Plan* was an overarching plan to manage the demand and efficiency to reduce the growth of consumption of electricity. In the two energy plans, references to water and food aspects were minimal. Water was usually mentioned in terms of hot water systems and hot water programs with no mention of the overall water sector. Minor reference was given to the agriculture sector including the enabling of agricultural leaseholders to sublease for wind farms and other renewable technologies. The *Powering Queensland Plan* (2017) represented a number of energy initiatives that were designed to stabilise electricity prices, foster a low-carbon economy as well as maintain energy security and reliability. The only mention related to water and food-related aspects was in terms of investment in water infrastructure and in digital metering for agricultural customers. Energy policies had very little reference to the water and agriculture sectors.

Food policies included a draft policy framework, *Food for a growing economy* (2015) by the Bligh Labor government, a *Food and Fibre Policy* (2015) by the Newman Liberal Government and the *Roadmap and Action Plan* for agriculture and food research, development and extension. Policies focussed on driving growth, investment and productivity in the sectors. Policies also had few minimal references to water and energy. Only in the draft policy framework was water and energy mentioned in relation to the need for such resources to be used efficiency and effective.

South Australia

Earliest policies sourced were from 2010 and only five relevant policies available, the first for water, two food policies, one climate change policy and the most recent energy plan. All policies were from Labor parties from the Rann government (2002-2011) and the Weatherill government (20110-2017).

The latest energy plan by the Weatherill government was released in 2017 with the vision 'to source, generate and control more of SA's power supply in SA… [to] increase self-reliance and provide reliable, competitive and clean power for all into the future'. The plan was to respond to energy security concerns following a number of blackouts experienced in the state and little investment to replace the closure of a number of coal-fired power stations. Emphasis was hence on the states' energy security. The plan discussed six key themes including battery storage and a renewable technology fund, new gas power plant, local powers, energy security target, gas incentives and new generation for more competition and hence lower prices. There was no mention regarding impacts on food or agriculture or other such related aspects. Although water was mentioned, references were limited to technologies such as pumped hydro. No role for food or water sectors in the plan.

There were two food policies from 2010, *SA Food- beyond the expectations of consumers around the globe'* and the recent, *Premium Food and Wine from our Clean Environment* plan. The first strategy aimed at enhancing the food and agricultural sector to drive growth with targets to generate $16 billion in gross food revenue, increase the food industry's contribution to SA's wellbeing while reducing the industries impact on the environment. Energy and water were mentioned in the context of environmental sustainability with a focus on the need to optimise water and energy usage and recognise water security as a weakness of the food industry. Both access to resources and development of infrastructure concerning energy and water were mentioned in the policy.

The most recent and ongoing plan, *Premium Food and Wine from our Clean Environment* (2015), was also about enhancing the sector. It focused on three key themes regarding building the industry's brand and reputation, growing capability through innovation for productivity and improvements across the value chain and securing production through ensuring biosecurity,

product integrity and food safety standards, the sustainable use of natural resources and efficient practices. The plan also mentioned water and energy sectors, in relation to water-based projects, water planning and water reforms included in the plan and in supporting energy efficiency.

The states, *Water for Good* policy released in 2010 was a comprehensive document covering a wide range of water-related aspects including energy and agriculture, which were mentioned throughout the plan, hence reflecting consideration of energy and agriculture interlinkages. The plan aimed to provide the state 'with the most secure water supply system in southern Australia' and where 'Greater Adelaide will not need water restrictions – beyond permanent water conservation measures – more than once in every 100 years'. The plan was to ensure water supplies were 'secure, safe, reliable and able to sustain continued growth'. The plan was a long-term water plan to guide water policy into the following decades. The plan provided 94 actions focussing on the diversification of water sources, water conservation, water efficiency and the modernisation of the water industry (Water for Good, 2010, p.18). Key actions included the doubling of the capacity of the Adelaide Desalination Plant and significant increases in water recycling and groundwater management.

Of all policies, the water plan was most integrated in terms of considering other energy and food sectors, although the food policies considered water and energy aspects. The energy plan was the least integrated with barely any mention to the two other sectors. During the same years, however ministers had separate responsibilities.

Tasmania

EWF policies reviewed for Tasmania date back until 1997, from the Rundle Liberal government to the Labor governments from 1998 to 2014 under Premiers Bacon, Lennon, Bartlett and Giddings up until the current Hodgman Liberal government.

The main objective of Tasmania's energy strategy in 2015 was to 'restore energy as a competitive advantage for Tasmania'. Its priorities focussed on the affordability of energy and competitive prices, consumer choice, state growth and renewable energy. Water was referred to in the context of hydroelectricity, the main source of energy in the state whereas reference to agricultural-related aspects was in terms of the potential for bioenergy from agricultural by-products.

Two water-related policies included the State Policy on Water Quality Management in 1997 and an interim Water Resource Policy and both provided for the sustainable management of Tasmania's water with recognition of water quality and environmental considerations. Agricultural water use was discussed in the first state policy regarding both irrigation, stock watering and management of pollution from agricultural run-off. There was no mention of energy

or other food-related aspects. The second policy neither had any mention of energy or food-related aspects.

There were four main food policy documents. The first in 2009 was the 'State Policy on the Protection of Agricultural Land' aimed 'to conserve and protect agricultural land so that it remains available for the sustainable development of agriculture, recognising the particular importance of prime agricultural land'. Both water and energy were considered in this policy under its policy principles. Water and food were considered in relation to irrigation development and the protection of agricultural land. Energy considerations were in relation to regulating the development of utilities and extractive industries activities. *Food for all Tasmanians* (2012) focussed on food security as well as considering water security as important for food security. Minor mention was made to agriculture and energy acknowledging how both can influence food policy. In the states' *Agri-food Plan* (2016), focus was on increasing investment, improving productivity and developing the workforce. Water initiatives comprised a large component of the plan of which initiatives for water resources and irrigation were developed. The latest White Paper, *Growing Tasmanian Agriculture,* although focussed on industry growth and did not make any reference to water or energy-related aspects. Some integration of EWF integration was evident in Tasmania's EWF policies. Since 2014, only water and food have been combined responsibilities of ministers.

Western Australia

There were a number of EWF policies since 2006 from the Carpenter Labor government to the Barnett Liberal Government and the present McGowan Labor government.

The Carpenter Labor government released two water policies, the *State Planning Policy 2.9 Water Resources* under the *Planning and Development Act of 2005* and the *State Water Plan* (2007). The first water policy's objectives included protecting, conserving and enhancing water resources, ensuring the availability of suitable water resources through improving quality and quantity of resources and the promotion of the sustainable use of water resources. The only mention was given to agriculture as part of water resource values and there was no mention of energy-related aspects. The *State Water Plan* (2007) reinforced the sustainable management of water with consideration of the natural environment, cultural and spiritual values, quality of life and economic development. A number of priority actions were listed focusing on using water wisely through conservation, efficiency and recycling, water planning, investments, environmental protection involving catchment protection, security of water for the environment and use through entitlements, trading and metring as well as safe drinking water. Both the agriculture and energy sectors were discussed in terms of their water use. Energy was mentioned throughout the plan.

In 2013, a position paper *Securing WA's water future,* was released by the Barnett government with the vision 'for the people of WA to benefit from secure access to water resources in the decades ahead, for our water management framework to maximise the productive value of water, minimise long-term costs to water users, industry and government, and protect the water-dependent environment'). Focus, however, was on sector-specific issues related to investment, rules and transparency and market-based mechanisms. Minor mention was given to energy and agriculture as users of water.

The *Strategic Energy Initiative 2031* (2013) focused on achieving affordable, secure, reliable and cleaner energy, to meet its vision for a 'diverse and secure energy supply, proactive energy planning, effective and efficient delivery, informed and responsible use and capacity building'. While it acknowledged the relationship between energy and water through supply and infrastructure requirements, there is no mention regarding agriculture. Relevant agricultural policies such as *Agrifood 2025*, focused on agricultural sectors performance and had no mention to energy-related aspects or water-related aspects. There was limited integration between EWF policies in WA.

Northern Territory

Few policy related papers were reviewed for the Northern Territory, at least one policy relevant for each sector. The *Our Water Future* (2015) focussed on water for the economy; safe, secure drinking water and healthy catchments, aquifers and aquatic ecosystems. Water was mentioned as an input for energy sectors such as in mining and petroleum development and for agricultural sectors. The security of water for these uses was an important part of the state's plan. In the same year, the government released a *Health Nutrition and Physical Activity Strategy* with the aim to improve food security and support healthy diets for children and adults. Food security was defined as 'the ability of individuals, households and communities to acquire appropriate and nutritious food on a regular and reliable basis, using socially acceptable means' and in the context of the NT improving food security was associated with access to food and access to healthy food. While the water was only mentioned in terms of drinking water for healthy diets, other water sector and energy sector concerns were not relevant to the policy.

The territory's *Roadmap to Renewables* (2017) focusses on renewable energy with the goal of achieving 50% renewable energy by 2030 while ensuring affordability of energy, reliability and security. It only considered water in terms of solar hot water systems and neither mentions other aspects of water or food. The recent policy documents, as described above, lack integration between EWF.

Australian Capital Territory

The policies reviewed for the ACT have included energy and water policies from the three previous Labor governments under Premier, Stanhope, Gallagher and Barr. No food or agriculture-related food policies were sourced, and this was likely due to the minimal role of agriculture in the Territory.

Each government was responsible for a water policy. The *Think Water, ACT Water Strategy* (2004) was to address a range of water issues facing the territory including water supply options, efficiency, quality, urban design, catchment and riparian zone management. Targets included reductions of water usage specifically, 12% less water usage per capita and the use of treated effluent (between 2003 and 2013) and 25% less water usage per capita by 2023, controlled nutrients and sediments entering Act waterways and controlled intensity and volume of urban stormwater flows and runoff. The policy, however, had no mention of energy or food-related aspects. The following water policy ten years later, *ACT Water Striking the Balance* (2014) pursued three outcomes, firstly healthy catchments and bodies, sustainably water supply and efficient use and a community that values and enjoys healthy catchments. The policy however neither had any mention of any energy-related aspects or agriculture aspects. Unlike other states where water is mostly used by agriculture, water in the ACT is mostly for urban areas, explaining the limited attention to water for agriculture. Only in the most recent 2016, *Draft Water Resource Plan* for surface water and groundwater was there mention of agriculture in terms of the risks of agricultural impacts on water quality. Only minor mention of agriculture in this draft policy.

The *Sustainable Energy Policy 2011-2010* (2011) comprised of four targets; to secure and affordable energy, smarter use of energy, cleaner energy and growth in a clean economy. No reference was made of agricultural or food aspects in terms of affecting or being affected by the policy. Only minor reference to water made in terms of water efficient, water and energy programs, the efficiency of water heating and solar hot water systems. Policies similarly had reflected limited integration between EWF policies and considerations of EWF aspects.

Appendix K. EWF Legislation

The following provides details regarding EWF legislation to support discussion in Chapter 8.

Commonwealth legislation

In the years after the formation of the federation, there were few pieces of Commonwealth legislation specific to EWF sectors. Legislation included trade legislation for tariffs and bounties (relevant to the agricultural sector), River Murray legislation and other mining, oil and minerals exploration legislation.

Since 1970, the number of laws enacted by the Commonwealth in the areas of EWF was greater than the previous periods. Over the last two periods, the government has played a greater role in energy and water, and this is evident in Commonwealth legislation. Only in the last two periods has the Commonwealth government been responsible for legislation in energy and responsible for a greater number of legislation in water, both areas under the power of states.

From the 1970 to the late 1990s, some of the main pieces of energy legislation included the Snowy Mountains Hydro-Electric Power Act 1975, Liquid Fuel Emergency Act in 1984, National Electricity Act and Regulations in 1996, the Snowy Hydro Corporatisation Act 1997, the Gas Pipelines Access Act (Commonwealth), 1998. These laws were enacted to address national and inter-state energy issues. Legislation in the 1990s supported the changes from economic reforms such as the development and operation of the interstate electricity market, corporatisation of government agencies in EWF sectors and the implementation of third party access to gas pipelines, for greater competition in the gas sector.

Water-related legislation during the period included, in addition to the Snowy Hydro legislation, legislation on River Murray Waters and subsequently the Murray-Darling Basin as well as legislation for financial assistance to support water resource development in the states.

Agriculture and food-related legislation at the Commonwealth level included several laws and were enacted to support reforms in a number of rural industries and to support changes in trade arrangements. These ranged from broad sector legislation such as the Rural Adjustment Act 1992 and specific industry legislation such as the Dried Vine Fruits Stabilisation Act 1971, Meat Export Charge Act 1973, Sugar Agreement 1975, Dairy Produce Act 1975, Wheat Marketing Act 1979 and the Fisheries Levy Act 1984 to name a few. These legislation covered areas of marketing and pricing and industry operations covering mostly sector-specific elements.

Apart from the Snowy Hydro legislation, no legislation covered multiple EWF sectors and there was little mention of other sectors. For example, while the National Electricity Objective seeks to

achieve security of electricity supply through efficient investment and efficient operation, also with respect to price, quality, safety and reliability, there is no mention of impacts of other water and agricultural sectors that may also influence security of electricity. The only relevant pieces of legislation with potential scope across EWF sectors were environmental legislation. The first pieces of legislation for the environment were enacted in the 1970s.

From the 2000 to the present, an even greater number of energy legislation was enacted at the Commonwealth level including those further supporting market reform, national gas market legislation and the national energy retail law as well as legislation enforcing renewable energy schemes and clean energy. Only in renewable energy legislation were there minor references of water, in terms of solar hot water provisions and other water-related renewable energy technology.

During the period, important water legislation was implemented, namely the Water Act 2007. The Water Act 2007 was a milestone in water governance, legislating changes centred on improving the governance and management of the Murray-Darling Basin, to be applied and enforced in all states. Although targeted to most water users, no special mention was given to agriculture, food or energy sectors or provisions for energy and food security. However agricultural water users are generally targeted.

Fewer laws have been enacted in relation to agriculture and food. Some of the main pieces of legislation have included the Biosecurity Act 2015 along with the Food Standards Code. Neither indicate consideration to water or energy sectors. The extent that water is considered in the Biosecurity Act is in the relation to the prevention of biosecurity risks associated with ballast water and the potential for ships to introduce foreign and invasive species through discharge of ballast water. This, however, did not concern the water sector. Mentions of energy and water was also absent in the Food Standards Code particularly in sections dealing with primary production.

Climate change legislation was enacted including the Clean Energy Act 2011. Developed by the Gillard Labor Government to introduce carbon pricing, the act was repealed in 2014 when the Labor government came into power. It neither had any reference to water and food-related aspects.

In legislation, linkages between EWF were less prominent indicating mostly siloed and sector-specific legislation. It is also difficult to compare EWF related legislation as they are distinct from each other and focussed on covering sector-specific aspects where linkages between EWF are not obvious.

State legislation

New South Wales

There were a number of pieces of specific legislation for EWF-related sectors along with local government legislation. Energy legislation before the formation of federation included mining acts and an electric lighting act, followed by gas and electricity acts in the following years after the formation of federation. Water legislation included water rights acts and the Water Act of 1912. Food sector legislation included assistance for farmers acts. Cross-sectoral acts included the Irrigation Act of 1912 and the Farm Water Supplies Act 1946.

Regarding references to other EWF sectors, local government acts as mentioned, specified powers and responsibilities of local councils concerning electricity, gas, water, sewerage and food. Mining Acts also covered water use for mining rights holders which were different to water rights specified in water acts. Protection of water sources and agricultural land was also provided for in mining acts, where pollution was deemed as offences. Water Acts introduced water rights covering agriculture and irrigation, however, with no mention regarding power generation. While section 9 of the Electricity Development Act 1946 was to promote and encourage the development and use of natural resources in connection with generating electricity, there was no mention within the Act of possible impacts on others sectors. However, it did provide for extension and improvement of electricity works to rural districts. The Electricity Commission Act 1950 provided for the cooperation and coordination between the Electricity Commission and relevant water organisations to discuss water use for electricity. Organisations included the Water Conservation and Irrigation Commission, Snowy Mountains Hydroelectric Authority, River Murray Commission and any statutory authority body representing the Crown relating to the use of water for hydro-electric generations.

Legislation from the 1970s to 1999 in NSW included a number of energy acts including mining act, water acts, with only one relevant food-related act.

Energy legislation included mining legislation, electricity and gas legislation and legislation related to the authority and administration of utilities. Only few pieces of legislation included references to other sectors and this was mostly related to the water sector and not the food sector due to their similarities as utilities. The Energy and Utilities Administration Act 1987 covered both energy and water sectors in its scope with specific objectives related to both sectors. Energy legislation focused on management of supply and use of energy, economic development stimulated by the energy sector, efficiency and cost-effectiveness, safety and utilisation. Water legislation focussed particularly on water savings, through reduced demand, water saving technologies and water saving areas. The Essential Services Act 1988 covered both energy and water, which were both considered as essential services for the community. The Act required protection of these services from disruptions, hence providing for energy and water security. The Mining Act 1992, like its preceding versions, provided for rights to access water where owners

and occupiers of land were permitted to have free and uninterrupted access. Other energy-related acts had minor or no references to water. The Gas Supply Act 1996 neither had provisions for water or land, currently both important considerations for gas developments.

Water legislation included the River Murray Waters Act and the subsequent Murray-Darling Basin Act 1992. The Water Administration Act 1986, was a major piece of water legislation during this period along with Catchment Management Act in 1989. Other acts included the Water Supply Authorities Act 1987 and the Water and Environmental Planning Legislation Amendment Act 1997. Water legislation had very little mention of other energy and food-related aspects, no special mention of energy or food sectors. In Acts that legislated for special committees such as in the Catchment Management Act, there was no provision to facilitate membership of energy and agricultural representatives. The Clean Waters Act 1970, however, provided for the membership of primary industry representatives in the Clean Waters Advisory Committee. No other specific reference was given to agriculture and energy sectors. The Food Act 1989 referenced water in the provisions for regulations where regulation could be made for the approval of sources of water. There was no mention related to sources of energy.

Fewer pieces of legislation were enacted from 2000 to the present including the National Gas Act 2008, Water Management Act 2000, Water Industry Competition Act 2006 and the Food Act 2006.

The Water Management Act 2000 sought to 'provide for the sustainable and integrated management of water sources of the state' with emphasis on ecologically sustainable development, environmental protection and social and economic consideration (*Water Management Act* 2000). The Act involved water management principles involving water sharing, water use, drainage management, floodplain management, controlled activities and aquifer interference. The Act included provisions for irrigation and agricultural water use as well as provision for water use by electricity generators, mining and mineral exploration activities, in relation to access licenses. While agriculture linkages and energy linkages were apparent, mention of energy-related aspects were limited. Food-related Acts neither accounted for water use or energy use, only mentioning the extent to which the food act applies to water supplies of which the act excludes.

Legislation in NSW from both periods appeared mostly siloed. In the period from 1970s to 1999 with the most integration seen in energy sector legislation, although such were limited to connections with water and mostly in terms of water savings and technologies. From 2000 onwards, integration was evident in the water legislation, accounting for both agricultural and energy users.

Victoria

Victoria had a number of energy-related legislation compared to legislation for other sectors, also including Mines Acts, Electric Light and Power Acts, and other Fuel and Power related Acts. Water legislation included the Water Acts 1890, 1905 and 1915 as well as a River Improvement Act 1948 and Groundwater Act 1969. Some agriculture sector related acts included agricultural colleges legislation and the rural finance corporation legislation and the first food-related act in the country, the Pure Food Act 1905, providing for food regulation. The Irrigation Act of 1886 was an important piece of legislation for the state providing for the vesting of rights to use water with the Crown. Local government acts similarly specified powers and responsibilities of local councils in areas of electricity and gas, water and food.

Several of the acts had cross-sectoral references. Electric Light and Power Act 1928 covered the protection of water and gas steam and other pipes in the carrying out of works. Soil Conservation and Land Utilization Act of 1947 established the Land Utilization Advisory Council providing for the cooperation and coordination of representatives of Agriculture, Forests, Lands and State Rivers and Water Supply Commissions to discuss land usage. The Soil Conservation (Water Resources) Act of 1965 authorised the Soil Conservation Authority to advise and as assist Landholders with regards to development and use of water resources. The Pipelines Act of 1967 provided for the requirement of approval (satisfaction) of water authorities concerning the construction of pipelines works to ensure construction would not impact on the use of water and will not cause pollution. The Groundwater Act of 1969 established the Groundwater Advisory Committee for which representatives of Mines, State Rivers and Water Supply Commission and agriculture were to be involved. While the Water Act 1915 specified water rights for irrigation there was no reference to water in the context of energy and water for mining as such was covered in mining acts such as the Mining Development Act 1896.

The majority of legislation enacted in Victoria was over the period between the 1970 and 1999, the majority being water-related legislation. Energy-related legislation included electricity and gas industry, and safety legislation. The Food Act was enacted in 1984, and the Environmental Protection Act was enacted in 1970.

The Electricity Industry Act 1993 and the Gas Industry Act 1994 were both enacted to support the restructuring of both electricity and gas industries. The Electricity Industry Act 1993 made references to water regarding water diversion by electricity corporations subject to the Water Act 1989. Minor references to water were made in the Gas Industry Act 1994. No mention was given to agriculture or food legislation.

The Water Act 1989 had various purposes, to provide for integrated management, promote orderly, equitable and efficient use of water conservation and sustainable use, deal with surface and groundwater resources treatment, provide responsible and efficient services and ensure

environmental protection and protection of water rights. The Water Act covered agricultural related aspects in particular irrigation and references concerning electricity was in relation to the State Electricity Commission and its right to use water. The Catchment and Land Protection Act 1994 provided a framework for integrated management and protection of catchments and management of land and water resources. At the same time, it provided regulation for extractive industries in these catchment areas hence considering impacts of energy-related industries. The Food Act 1984, referenced water about regulations to be made regarding the maintenance of adequate water supply and sources of water. No reference was made regarding energy use.

Fewer pieces of legislation were enacted between 2000 and the present, including the National Gas Act, the Energy Retail Code, the Safe Drinking Water Act 2003 and the Climate Change Act 2017. Only the Climate Change Act had cross-sectoral references to water in the context of water management in carbon sequestration, however a minor reference. There were no significant cross-sectoral reference were evident in other acts.

Legislation during the two periods reflected limited integration between EWF. The legislation demonstrated the most consideration to other energy and food-related aspects.

Queensland

In Queensland, there were various EWF Acts. Energy-related Acts included the mining acts and electricity acts. A number of water acts were enacted soon after the formation of the federation, including the main water act, the Water Act 1926. Separate water-related acts included the Irrigation Act 1922, which covered water and food linkages and the Water Power Act 1922 in the same year, which covered the generation of electric energy and water power. Other acts with cross-sectoral references included the Rights in Conservation and Utilisation of Water Act 1910 covering water rights for agriculture and irrigation and water for electric power. It also mentioned rights to water for generating electricity for lighting. Mining water was covered in mining acts that provided for the protection of water from mining pollution. The Land and Water Resources Development Act 1943 provided for the use of land and water resources, the investigation of water resources and the construction of irrigation undertakings. However, in the Act, there was no specific mention regarding energy-related aspects.

Between 1970s and the present, the majority of legislation for EWF were enacted between 2000 and the present, including electricity and gas acts, water acts and a number of food-related acts.

The Water Resources Act 1989 was enacted to ‘consolidate and amend’ previous water legislation. This concerned ‘rights in water, the measurement of water, the construction, control and management of works with respect to water conservation and protection, irrigation, water supply, drainage, flood control and prevention, improvement of the flow in or changes to the

courses of watercourses as well as the safety and surveillance of dams'. While it provided for irrigation and agricultural water use, no mention was given to energy-related aspects only regarding mining sector use. The Water Act 2000 similarly covered a number of water-related issues involving irrigation, agricultural use, mining sector use and also electricity use which was particularly mentioned in the context of water supply emergencies with provisions for water to electricity generators during times of emergencies. The Water Act 2000 was comprehensive in covering a number of water-related aspects, especially in dealing with water security planning which was not evident in other state water acts.

The Food Act 1981, which dealt with the preparation and sale of food and standard for food, like similar food acts in other states, mentioned water in provisions regarding regulation of adequate supply of water and sources of water. No mention, however, was given to energy-related aspects. Of energy-related legislation, only the Petroleum and Gas (Production and Safety) Act 2004 made references to water throughout the legislation, with two major sections of the legislation concerning water rights for petroleum tenures and the water monitoring authorities.

The Integrated Planning Act 1997, was an Act to promote integrated planning to support ecologically sustainable development, managing the way in which development occurs and managing the effects of development on the environment. While the legislation was not solely targeting EWF sectors, the legislation provided for broad principles for which EWF could be dealt with in an integrated manner.

South Australia

Relevant legislation included mining and electricity acts as well as several water-related acts including Mining Act 1893, Adelaide Electric Supply Company Acts, 1897, and the Water Conservation Act 1888. Other relevant legislation included local government acts. The Control of Waters Act 1919 covered water for cultivation and grazing but had no mention of energy-related aspects such as electricity or mining.

EWF legislation from 1970s to the present included for energy, mining legislation, electricity and gas legislation and regulation as well as both national energy legislation, for water, water resources legislation and legislation on the River Murray and the Murray Darling Basin and food, two food Acts. Other legislation included the Environmental Protection Act 1993, the Natural Resources Management Act 2004 and the Irrigation Act 2009.

The Mining Act 1971 with the main purpose of regulating and controlling mining operations provided for regulation to prevent water pollution from mining operations but had no specific mention of farming and agriculture impacts.

The Water Resources Act 1990 provided for the management of water resources, the preservation of water quality and provision of water sharing. The Act dealt with a number of issues focussing on promoting the recognition of water as a limited and important resource of the state, the establishment of systems to ensure efficient use, sharing of water as well as the recognition of the ecological, scientific, historical, cultural and archaeological importance of water. One feature of the Act was to the establish the SA Water Resources Council which under legislation brought together a representatives of the Engineering and Water Supply Department, the Department of Lands, Department of Agriculture, Department of Environment and Planning and the Department of Mines and Energy. Such membership arrangements represented integration of decision-makers, with representatives of EWF sectors. Other mentions of water were related to irrigation, and there was no other mention of energy or food-related aspects.

The following Water Resources Act 1997 repealed the Act of 1990. The Act aimed to establish a system for use and management of water resources that would ensure that the use and management would sustain the physical, economic and social well-being of people at the same time facilitating economic development. This involved both the need to ensure resources to meet future needs and the need to protect the ecosystems. The Act also legislated for the establishment of a new Water Resources Council, but membership differed from that of the previous legislation with requirements only for a representative with knowledge of and experiences in the use or development of water resources for primary production. There were no requirements for a mineral and energy representative. While references to agriculture and farming were evident, there were no references to energy or mining-related aspects. The Irrigation Act 2009 although reflecting linkages between water and agriculture, neither had mention to energy aspects.

The Natural Resources Management Act 2004 was an important act in terms of facilitating and promoting sustainable and integrated management of the state's natural resources. The protection of both water and land were key components of the Act. Regarding water, the Act covered various issues from rights to water, control of activity affecting water, licensing and allocation of water, reservation of excess water by the Minister, conservation matters and other water-related matters. In addition to providing for water management, one of the key objectives was also 'to support sustainable primary and other economic production systems' (*Natural Resources Management Act* 2004, s. 7) for which the act explicitly referred to agriculture and mining and their contribution to the economy. Hence the Act had scope to consider all three EWF matters. All other acts had no references to other linked sectors.

Tasmania

Legislation included local acts, mining acts, water acts and the Hydro-Electric Commission Act 1929. Like other mining legislation, mining acts provided for water licences for mining. While

the Hydro-Electric Commission Act 1929 covered hydro-electricity and state control of water, unlike other water-related acts in other states, there was little mention to agriculture as the focus was on water for electricity. The Water Act 1957 established years later took account of water and food linkages. In the establishment of the Rivers and Water Supply Commission, the Act specified the need for an agricultural member as part of the Commission to advise on aspects relevant 'in particular to the increase of food production' (*Water Act* 1957, s. 4.2c). The Act provided for the control of water use for agricultural purposes and provided for consultation with the Minister for Agriculture. It also distinguished the existing water rights granted by the Hydro-electric commission for electricity purposes.

From 1970 to the present, EWF legislation included electricity and gas acts, a water management act and regulations and several food-related acts. Electricity Acts such as the Electricity Supply Industry Act 1995, covered both electricity and water aspects as a result of the legislation's relevance to the state's hydropower developments. However, such Acts gave little reference to agricultural related aspects. Water Management Acts similarly took account of electricity, a key factor for water management, as well as irrigation activities. Like other state food acts, there was no mention of energy-related aspects and only mention of water concerning regulations for maintaining adequate water supply. The only integrated legislation were water management legislation covering water use for both energy and agricultural purposes.

Western Australia

In WA, there were various water-related acts covering various areas including metropolitan water, water boards, water rights and country water and sewerage, compared with energy-related acts including mining and electricity acts. Like others states, the first municipal acts specified powers and responsibilities of local councils in electricity and gas, water and food. The Rights in Water and Irrigation Act 1914 covered irrigation, however, there was no mention of energy-related areas such as electricity regarding water use. In the Electricity Act 1945, mention of water was in the provision for the fixing of the amount charged for electricity Commission to consider 'oil and water'. The Acts also included provisions for water in the carrying out and installation of transmission and distribution works. The State Electricity Commission Act 1945 mentioned water in providing for the Commission to have certain rights to water, exercising the control and use for the purposes of the act the waters in all rivers, streams, watercourse, lagoons, lakes, swamps and marshes.

There were a number of energy and water legislation in the state with one Food Act in 2006.

Key legislation included the Fuel, Energy and Resources Act, Mining Act in the 1970s, Energy Operators Act as well as electricity industry acts and gas supply acts. Water legislation included

the Waterways Conservation Act 1976, Water Authority Act 1984 and the Water Services Act 2012.

The only cross-sectoral reference evident in the state's legislation was in water legislation, however only to the extent of consideration to agriculture and irrigation with no mention of energy-related aspects. Water Conservation Act included the need to consider agricultural interests in water planning, but no special mention was made for electricity or energy-related aspects. The Water Services Act 2012 also considered agriculture and irrigation but had no reference to energy-related aspects.

Northern Territory

In the Northern Territory, energy acts included both national based gas, and electricity acts, water legislation, such as the Water Supply and Sewerage Act 2016, and there were two food and agriculture-related acts, the Pastoral Land Act 2011 and the Food Act 2016.

In the Water Act 2016, although no reference was given to electricity, reference was given to mining and petroleum activity in the context of pollution, where regulation of the Act regarding pollution is not applied to pollution in mining and petroleum activity. Numerous references were given to agriculture and irrigation, recognised as users of water. The Pastoral Land Act 2011, 'to make provision for the conversion and granting of title to pastoral land and the administration, management and conservation of pastoral land, and for related purposes' (*Pastoral Land Act* 2011) made references to electricity and water, providing for the access to water and electricity.

Australian Capital Territory

The most recent energy legislation in ACT included the national energy laws such as the National Electricity Act, the National Gas Act and the National Energy Retail laws enacted in 2012. In ACT, electricity and water have been governed to together under joint legislation such as the Energy and Water Act 1988, the Electricity and Water Act 1988 (established the Electricity and Water Authority to be responsible for electricity and water services in the territory to supply and manage use of electricity and water) and the Utilities Act 2000. Such legislation provided for the provision of electricity, gas, water supply and sewerage services. There was no mention of food or agriculture related areas. The Authority had no responsibilities related to agriculture.

There were also two water resource acts introduced during the period, the first in 1998 and the second in 2007. Both Acts were to provide for the management of the water resources of the Territory, the latter act emphasising sustainable management. Both provided for water allocation and licenses, with the second, more specific in dealing with water access entitlements. Neither made any special reference to irrigation or agricultural uses or energy-related users (including

electricity, gas or mining). Food legislation (Food Act 2001 and Food Regulations 2002) neither accounted for water or energy usage.

Table K1 lists a selection EWF legislation from each jurisdiction.

Table K1. EWF legislation

	Period	ENERGY	WATER	FOOD	CROSS-SECTORAL
COM	**1800s-1969**		River Murray Act 1915	Bounties Act 1907 Wheat Stabilization Act 1937 Wheat Acquisition Regulations 1939 Wheat Industry Stabilisation Act 1946 Sugar Marketing Assistance Agreement Act 1967 Sugar industry Assistance Act 1967 Number of other specific product acts related to trade	Australian Constitution Act 1901 National Security Act 1939
	1970-1999	Liquid Fuel Emergency Act 1984 National Electricity (SA) Act & Regulations 1996 (20 Jun) National Electricity Market Legislation Agreement 1996 (20 Jun)	River Murray Waters Act 1970 State Grants (Rural Reconstruction) Act 1971 (25 May) National Water Resources (Financial Assistance) Act 1978 River Murray Waters Act 1983 (14 Nov) Murray-Darling Basin Act 1993	Marginal Dairy Farms Agreement Act 1970 (23 Jun) Dried Vine Fruits Stabilization Act 1971 (16 Dec) Australian Apple & Pear Corporation Act 1973 Meat Export Charge Act 1973 Dairy Produce Act 1975 (20 Jun) Wheat Marketing Act 1979 Export Control Act 1982 Dairy Produce Act 1986 Fisheries Levy Act 1984 Torres Strait Fisheries Act 1984 Dairy Produce Act 1986 Primary Industries Research & Development Act 1989 Fisheries Administration Act 1991 (10 Nov) Fisheries Management Act 1991 (10 Nov) National Food Authority Act 1991 (27 Jun) Rural Adjustment Act 1992 Farm Household Support Act 1992 Imported Food Control Act 1992 Agricultural & Veterinary Chemicals Act & Code 1994 National Food Authority Amendment Act 1995 Australian Meat & Live-stock Industry Act 1997	Snowy Mountains Hydro Electric Power Act 1975 (24 Apr) Environment Protection (Impact of Proposals) Act 1974 Natural Resources Management (Financial Assistance) Act 1992 National Environment Protection Council Act 1994 Snowy Hydro Corporatisation Act 1997 Trans-Tasman Mutual Recognition Act 1997 Natural Heritage Trust of Australia Act 1997 National Environment Protection Measures (Implementation) Act 1998 Environment Protection & Biodiversity Conservation Act 1999
	2000-2018	Fuel Quality Standards Act 2000 Renewable Energy (Electricity) (Large-scale Generation Shortfall Charge) Act 2000 Renewable Energy (Electricity) Act 2000	Water Efficiency Labelling & Standards Act 2005 Water Act Bill 2007 (Cth) (8 Aug) Water Act 2007 (24 July 2008)	Horticulture Marketing & Research & Development Services Act 2000 Inter-governmental Food Regulation Agreement (FRA) 2008	Australian National Registry of Emissions Units Act 2011 Carbon Credits (Carbon Farming Initiative) Act 2011

		Australian Energy Market Agreement (AEMA) 2004 Australian Energy Market Act 2004 Trade Practices (Industry Coles-Oilcode) Regulations 2006 National Greenhouse & Energy Reporting Act 2007 (28 Sep) National Gas (SA) Act & Regulations 2008 National Gas Access (WA) Act 2009 Renewable Energy (Electricity) (Small-scale Technology Shortfall Charge) Act 2010 (28 Jun) Australian Renewable Energy Agency Act 2011 Clean Energy Act 2011 Clean Energy Regulator Act 2011 National Energy Retail Law (SA) Act 2011 Clean Energy Finance Corporation Act 2012 Clean Energy Legislation (Carbon Tax Repeal) Act 2014	Intergovernmental Agreement on Murray-Darling Basin Reform 2008 (3 Jul) Water Regulations 2008	Sugar Research & Development Services Act 2013 (29 Jun) Biosecurity Act 2015 (16 Jun)	Climate Change Authority Act 2011
NSW	**1800s-1969**	Mining Act 1874 Municipal Council of Sydney Electric Lighting Act 1896 Mining Act 1906 Gas Act 1912 Gas & Electricity Act 1932 Gas & Electricity Act 1935 Electricity Development Act 1946 Electricity Commission Act 1950 Pipelines Act 1967	Country Towns Water Supply Act 1880 Metropolitan Water & Sewerage Act 1880 Water Rights Act 1896 Water Rights Act 1902 Water Act 1912 Rivers & Foreshores Improvement Act 1948	Farmer's Relief Act 1932	Land Legislation Local Government Act 1906 Local Government Act 1919 Irrigation Act 1912 Farm Water Supplies Act 1946
	1970-1999	Coal Mining Act 1973 Mining Act 1973 Energy Authority Act 1976 (17 Nov) Gas Act 1986 (23 Dec) Energy Administration Act 1987 Energy & Utilities Administration Act 1987 Petroleum (Onshore) Act 1991 Mining Act 1992 (18 May) Gas Supply Act 1996 (25 Jun) Electricity Supply Act 1995 (21 Dec) National Electricity (New South Wales) Act 1997	Clean Waters Act 1970 Coastal Protection Act 1979 Water Administration Act 1986 (18 Dec) Water Supply Authorities Act 1987 Catchment Management Act 1989 Murray-Darling Basin Act 1992 (3 Nov) Sydney Water Catchment Management Act 1998 Catchment Management Regulation 1999	Food Act 1989	Heritage Act 1977 Environmental Planning & Assessment Act 1979 Environmentally Hazardous Chemicals Act 1985 Environmental Offences & Penalties Act 1989 Ozone Protection Act 1989 Protection of the Environment Operations Act 1997
	2000-2018	National Gas (NSW) Act 2008	Water Management Act 2000 Water Industry Competition Act 2006	Food Act 2003 Food Regulation Act 2015	

			State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 (1 Mar)		
VIC	**1800s-1969**	Mines Act 1890 Mining Development Act 1896 Electric Light & Power Act 1896 Mining Development Act 1915 Electric Light & Power Act 1928 State Electricity Commission Act 1928 Gas & Fuel Corporation Act 1950 Mines Act 1958 Electric Light & Power Act 1958 Fuel & Power Act 1965 Pipelines Act 1967	Water Conservation & Distribution Act 1881 Water Act 1890 Water Act 1905 Water Act 1915 River Improvement Act 1948 Groundwater Act 1969	Agricultural Colleges Act 1884 Pure Food Act 1905 Rural Finance Corporation Act 1949	Local Government Act 1874 Irrigation Act 1886 Local Government Act 1903 Farm Water Supplies & Drainage Advances Act 1943
	1970-1999	Electricity Industry Act 1993 Gas Industry Act 1994 Gas Safety Act 1997 National Electricity (Victoria) Act 1997 Electricity Safety Act 1998	River Murray Waters Act 1970 State Environment Protection Policy (Waters of Victoria)-Environment Protection Act 1970 Water Resources Act 1975 Water Act 1989 Heritage River Act 1992 (16 Jun) Murray-Darling Basin Act 1993 Catchment & Land Protection Act 1994 Water Industry Act 1994	Food Act 1984	Environment Protection Act 1970
QLD	**2000-2018**	National Gas Act (VIC) 2008 Energy Retail Code 2015	Safe Drinking Water Act 2003		Climate Change Act 2017
	1800s-1969	Electric Light & Power Act 1896 Mining Act 1898 State Electricity Commission Act 1937 Regional Electric Authorities Act 1945 - Southern Electric Authority Act 1952 - Northern Electric Authority Act 1963	Water Authorities Act 1891 Metropolitan Water & Sewerage Act 1909 Rights in Conservation & Utilisation of Water Act 1910 Water Act 1926	Sugar Agreement 1925	Municipalities Act 1858 Local Government Act 1878 Local Government Act 1890 Local Government Act 1902 Irrigation Act 1922 Water Power Act 1922 Land & Water Resources Development Acts 1943 Irrigation & Water Supply Commission Act 1947 Farm Water Supply Assistance Acts 1958
	1970-1999	Electricity Act 1976 Electricity Act 1994 Electricity National Scheme (QLD) Act 1997	Clean Waters Act 1971-1988	Land Act 1994	Integrating Planning Act 1997
	2000-2018	Gas Supply Act 2003 Gas Supply Regulation 2004 Petroleum & Gas (Production & Safety) Act 2004 Electricity Regulation 2006	Water Act 2000 Water Supply (Safety & Reliability) Act 2008 Environmental Protection (Water) Policy 2009 Water Legislation Amendment Act 2016	Food Production (Safety) Act 2000 Food Act 2006 Biosecurity Act 2014 Food Production (Safety) Regulation 2014 Food Regulation 2016	Energy & Water Ombudsman Act 2006

		National Gas (Queensland) Act 2008			
SA	**1800s-1969**	Mining Act 1893 Adelaide Electric Supply Company's Acts 1897 Electricity Act 1943			District Councils Act 1876 Municipalities Corporation Act 1890 Local Government Act 1902 Local Government Act 1934-1941
	1970-1999	Mining Act 1971 Gas Act 1988 Electricity Act 1996 Gas Act 1997 Gas Pipelines Access Act (South Australia) 1998 National Electricity (South Australia) Act 1996	Water Resources Act 1976 River Murray Waters Act 1983 Murray-Darling Basin Act 1988 Water Resources Act 1990 Murray-Darling Basin Act 1993 South Australian Water Corporation Act 1994 Catchment Water Management Act 1995 Water Resources Act 1997	Food Act 1985	Environmental Protection Act 1993
	2000-2018	National Gas (South Australia) Act 2008 National Energy Retail Law (SA) Act 2011 (1 July 2012) Electricity (General) Regulations 2012 Gas Regulations 2012	River Murray Act 2003 Murray Darling Basin Act 2008	Food Act 2001 Genetically Modified Crops Management Act 2004 Food Act 2001	Natural Resources Management Act 2004 Irrigation Act 2009
TAS	**1800s-1969**	Deep-Sinking Encouragement Acts 1899 (Mining) Mining Act 1912 Mining Act 1929	Water Act 1957 Metropolitan Water Act 1961		Rural Municipalities Act 1958 **1858** Local Government Act 1906 Tasmania Grant Act 1912 Hydro-Electric Commission Act 1929
	1970-1999	Electricity Supply Industry Act 1995 Energy Coordination & Planning Act 1995 Electricity - National Scheme Act 1999	Water Management Act 1999	Primary Industries Activities Protection Act 1995 Food Act 1998 (21 Jul)	
	2000-2018	Gas Act 2000 Gas Pipelines Act 2000 Electricity Reform Act 2012	Water Management Regulations 2009	Egg Industry Act 2002 Food Act 2003 Primary Produce Safety Act 2011 (25 Oct)	Climate Change (State Action) Act 2008
WA	**1800s-1969**	Mining Act 1904 Electric Light & Power Agreement 1913 Electricity Act 1945 State Electricity Commission Act 1945	Metropolitan Water Works Act 1896 Water Boards Act 1904 Metropolitan Water & Sewerage Act 1904 Rights in Water & Irrigation Act 1914 Country Areas Water Supply Act 1947 Country Towns Sewerage Act 1948 Western Australia Grant (Water Supply) Act 1948 Commonwealth	Agricultural Lands Purchase Act 1896	Municipal Institutions Act 1895 Municipal Corporations Act 1906
	1970-1999	Fuel, Energy & Power Resources Act 1972 Mining Act 1978 Energy Operators (Powers) Act 1979 Energy Coordination Act 1994 Gas Pipelines Access Act (Western Australia) 1998	Waterways Conservation Act 1976 Metropolitan Water Authority Act 1982 (27 May) Water Agencies (Powers) Act 1984 Water Authority Act 1984 Water Corporation Act 1995		Conservation & Land Management Act 1984 Land Administration Act 1997

	2000-2018	Electricity Industry Act 2004 Electricity Corporations Act 2005 Energy Operators (Electricity Generation & Retail Corporation) (Charges) By-laws 2006 Gas Supply (Gas Quality Specifications) Act 2009 National Gas Access (WA) Act 2009	Water Services Act 2012	Food Act 2006 Biosecurity & Agricultural Management Act 2007	
NT	**1970-1999**		National Territory Control of Waters Act 1981 Water Supplies Development Act 1987		
	2000-2018	National Gas (Northern Territory) Act 2014 National Electricity (NT) (National Uniform Legislation) Act 2015	Water Act 2016 Water Supply & Sewerage Act 2016	Pastoral Land Act 2011 Food Act 2016	
ACT	**1970-1999**	*Electricity Safety Ordinance 1971* National Electricity (South Australia) Act 1996 Electricity (National Scheme) Act 1997	Water Resources Act 1998		Energy & Water Act 1988 Electricity & Water Act 1988 Independent Competition & Regulatory Commission Act 1997 Nature Conservation Act 1980 Land (Planning & Environment) Act 1991 Environment Protection Act 1997
	2000-2018	National Gas Act 2008 National Energy Retail Law (ACT) 2012	Water Resources Act 2007	Food Act 2001 Food Regulation 2002	Utilities Act 2000 Planning & Development Act 2007 Climate Change & Greenhouse Gas Reduction Act 2010

Sources: *ABS Year Books Australia (1908-2012), Australasian Legal Information Institute (AustLII), Federal Register of Legislation, State and Territory registers of legislation*

Appendix L. EWF Pricing

The following provides details regarding EWF pricing to support discussion in Chapter 8.

Water supply, sewerage, lighting and gas

In the first developments of waterworks and lighting in the late 1800s, local governments had the power to price and charge for the provision of water supply, sewerage, lighting and gas services, enabling them to recover the cost of constructing and maintaining related works. These powers for setting special rates were provided for in legislation that often stated maximum prices or minimum prices, that on a yearly basis could be changed at the discretion of local government. The excerpts below show sections of local legislation regarding such pricing. At the time, all states had similar arrangements. Similar sections were seen in later enacted water acts and electricity-related acts. The establishment and charging of special rates were the responsibilities of relevant authorities for example, under NSW Water Rights Act 1896 by the Land Board. Under section 165 regarding *special rates for sewerage water*, and section 166 *special Water Rates* of the Municipalities Act 1867 in NSW,

> *"For the purpose of constructing and maintaining any works for or relating to the draining of lands water supply sewerage or lighting with gas or otherwise the Council of any Municipality may establish special rates and may levy the same upon the owners or occupiers of any property within the Municipality deriving any benefit or advantage from such works.' (Municipalities Act 1867, s. 165)*

> *"For the purpose of constructing and maintaining Water Works and ensuring a supply of pure water the Council of any Municipality may establish special water rates in towns and may levy the same upon the owners or occupiers of all houses in streets where the water mains are laid down Provided that no such special water rate shall exceed five shillings per annum for every separate room in a dwelling house." (Municipalities Act 1867, s. 166)*

Charging for electricity was also provided for in specific electric lighting Acts such as under section 12 of the Municipal Council of Sydney Electric Lighting Act 1896 (*Municipal Council of Sydney Electric Lighting Act* 1896, s.12) regarding an electric light rate with a specified amount.

Electricity-related acts also provided for uniform pricing for all consumers. This was seen in *Victoria Electric Light and Power Act 1896* under section 39 regarding *Charges for electricity* where,

> *"the undertakers shall not in making any agreements for a supply of electricity show any preference to any council company or person, and the charge for such supply shall be uniform throughout such area so that each council company or person shall be supplied at the same price and not less than any other council company or person…" (Electric Light and Power Act 1896b, s.39)*

Moreover, also under section 37 regarding charges for electricity of the Queensland Electric Light and Power Act 1896, "An Electric Authority shall not, in making any agreements for a supply of electricity, show any undue preference to any person" (*Electric Light and Power Act* 1896a, s. 37). In the 1930s, pricing of gas and electricity was based upon usage seen in legislation such as the *NSW Gas and Electricity Act 1932*. Under section 14 regarding *Standard price*

> *"…a gas; company shall charge for gas supplied by it on the basis of the number of gas units consumed, and an electric light company shall charge for electricity supplied by it according to the form and basis prescribed. The standard price to be charged by a gas company for gas supplied by it to private consumers by meter, or by an electric light company for any electricity so supplied, shall be at the rate set out in Schedule One to this Act or any addition to such Schedule: Provided that a gas company or electric light company may supply gas or electricity for industrial purposes (which term shall include the supply of gas or electricity in bulk to any gas company or electric light company for the purpose of distribution by that company to private consumers by meter) at a price to be fixed from time to time by a commission constituted for that purpose, and the price so fixed may be less than the standard price" (Gas and Electricity Act 1932, s. 14)*

Energy

Pricing was an important matter of energy policy during the 1970s, seen in the setting of the oil price to import parity in 1978 to its deregulation ten years later to market reforms. Reforms in energy sector sought to introduce competition and promoted changes to the pricing of energy towards competitive pricing where possible. Where not possible, for example, in transmission networks because of natural monopoly characteristics, regulated pricing was required.

Energy, particularly electricity (generation, transmission, distribution and retail), is currently subject to a mix of regulated and competitive pricing along the supply chain under the oversight of the Australian Energy Regulator (AER). Pricing processes vary across the states.

Wholesale Pricing

In the National Electricity Market (comprising of Queensland, NSW, Australian Capital Territory, Victoria, SA, and Tasmania), wholesale prices are to an extent competitive based on bids by generators to supply electricity. The National Electricity Market is a wholesale market where generators sell electricity and where the Australian Energy Market Operator schedules the lowest cost generation to meet demand every five minutes (AER 2017b, p. 24). Generators make bids to supply quantities of electricity at different prices. From the cheapest to the most expensive, generators are selected, and electricity is dispatched. The highest priced offer then becomes the dispatch price.

Gas market sales are through confidential contracts also involving spot markets. Gas is traded a day ahead of the relevant gas day, and the AEMO sets a day ahead (ex-ante) clearing price at each hub, based on scheduled withdrawal and offers by shippers to deliver gas. All gas supplies according to the schedule is settled at this price. Market provides incentives for participants to keep their schedules (AER 2017b, p. 75).

Transmission Pricing

Electricity networks (transmission and distribution) are regulated. The AER sets the amount of revenue that a network business can recover from customers for the use of its networks (AER 2017b, p. 94) hence influencing the transmission and distribution price components. The regulator determines efficiency costs of provided electricity network services and access prices for covered gas pipeline services. Electricity networks are subject to full economic regulation while gas is subject to a mix of full and light regulation (AER 2017b, p. 100). Network businesses periodically submit regulatory proposals (for electricity networks) and access arrangements (for full regulation gas pipelines). AER reviews proposals and determines amount of revenue. Pricing determination involves a 'building block model' accounting for operating and maintenance expenditure, capital expenditure, asset depreciation costs, taxation liabilities, and an appropriate return on capital to network owners.

Regulatory investment tests are to ensure network businesses are efficient, requiring a network business (both in transmission and in generation) to evaluate a proposed investment against credible alternatives. Investments must pass a cost-benefit analysis or provide the least cost solution to meet network reliability standards.

Retail Pricing

Energy bills paid by retail customers cover costs of producing and transporting energy, as well as retailer costs and regulatory obligations (AER 2017b, p. 127). Electricity retail bill comprise of network costs (40-55% of a bill), wholesale costs (40-50% of a bill) and green schemes associated with renewable generation and energy efficiency (5-15 per cent of a bill) (AER 2017b, p. 127). Gas bills, however, are less transparent as a result of private and confidential contracts. According to AER (2017b, p. 127) estimates of the breakdown of retail gas prices are 20% for wholesale costs, 30-70% for distribution of pipeline charges, and 3-15% for transmission charges.

Retail pricing across the states varies. In some states, retail pricing is deregulated while in other state government agencies regulate retail pricing (AER 2017b, p. 130). In Victoria, SA, NSW, and in southeast Queensland retail electricity pricing is competitive, with price regulation removed respectively in 2009, 2013, 2014 and 2016. Retail prices are regulated in Tasmania, ACT and rural Queensland.

Water

From the late 1800s, state legislation provide for water to be vested in the Crown and from then water use was subject to influence of governments who were responsible for allocating water licenses. While governments had control over water, their role in water was directed at managing water users rather than regulating water consumption in terms of volumes of water. In the rural water sector, consumption of water was promoted, 'entitlements to water from water supply schemes were granted to farmers for free; these were mostly regional development initiatives, and farmers were encouraged to develop their land to utilise the available water' (Parker & Speed 2010, p. 7). Waterworks were often subsidised by governments to achieve developmental goals.

In the urban sector, water charges were based on a fixed rate on property (PC 2011, p. 30), set under the discretion of councils or public enterprises, independent of consumption and thus not a means of regulating water use. Pricing of water was rather considered a tax (Butlin, Barnard & Pincus 1982, p. 244). Councils could raise rates according to their required revenue and could lower rates according to revenue surplus. Rates were not used to regulate consumption and rate rises did not necessarily to encourage lower consumption of water. Recognition of water overuse brought attention to water pricing as part of water reforms, although this was also tied to the need for the proper funding of water infrastructure.

Water reforms promoted changes to prices of water, towards consumption-based pricing and cost-recovery. In the urban sector, two-part tariffs and block pricing involving a fixed charge and one or more per unit volumetric prices has been implemented in all states (PC 2011). Water pricing was an important feature of water reforms which aimed to properly assign appropriate prices to water to improve the efficiency of water use. Although water pricing is determined according to states, the NWI provides guiding principles over pricing shown in Table L1.

Table L1. National Water Initiative Pricing Principles

PRINCIPLES	COMPONENTS
Principles for recovering capital expenditure Two approaches used to calculate the revenue requirement for capital investments the annuity approach – forecasts asset replacement and growth costs over a fixed period and converts these to a future annualised charge the Regulated Asset Base (RAB)/ 'building blocks' – allowance for a return of capital (depreciation) and a return on capital Revenue Requirement = Benchmark operating expenditure (operations, maintenance, administration costs) + Return on capital (RAB) + Return of capital (RAB) or depreciation	Cost recovery for new capital expenditure To achieve full cost recovery of capital expenditure through return of capital and return on capital or a renewals annuity and a return on capital Valuation of new assets Valuation of legacy assets Recovery of legacy capital expenditure Rolling forward asset values after the legacy date Contributed assets
Principles for setting urban water tariffs Charging structure adopted by urban water business generally comprised service availability charge – the residual component to be recovered to meet the revenue requirement after the revenue from water usage charges has been estimated water usage charge – set with reference to the long run marginal cost of supply	Cost recovery – upper revenue bound – to avoid monopoly rents, a water business should not recover more than the operational, maintenance and administrative costs, externalities, taxes or tax equivalent regimes, provision for the cost of asset consumption and cost of capital (calculated using a Weighted Average Cost of Capital (WACC) Tariff structure – two-part tariff Cost reflective tariffs Setting the service availability charge – difference between the total revenue requirements as determined in accordance with Principle 1 and the revenue recovered through water usage charges and developer charges. Can vary between customers considering service demands and equity conditions Pricing transparency Over recovery of revenue Differential water charges Setting developer charges Capping developer charges
Principles for recovering the costs of water planning and management	Water planning and management activities Government activities Cost-effectiveness test Cost allocation Differentiation of costs Community Service Obligations
Principles for recycled water and storm water use	Flexible regulation Cost allocation Water usage charge Substitutes Differential pricing Integrated water resource planning Transparency Gradual approach

Source: National Resource Management Ministerial Council (NRMMC 2010)

There are two prices relevant for water: urban water prices (utility prices that include sewerage prices) and agricultural water prices. Most water and sewerage services are operated by state monopolies and are regulated by independent price regulators which vary according to the different states. Water usage as mentioned is priced using two-part tariffs determined from metered usage while sewerage continues to be based on rates as such is not metered. Prices charged take into requirements for infrastructure replacement, building of new infrastructure, bulk water costs and general operating costs.

Agricultural water prices are expected to follow the NWI principles that emphasise consumption-based pricing, full cost recovery, prices that ensure business viability and avoid monopoly rents and the recovery of environmental externalities, although not defined. According to the National

Water Initiative Pricing Principles, to ensure business viability, lower bound pricing principle should be followed where,

> *'a water business should recover, at least, the operational, maintenance and administrative costs, externalities, taxes or TERs (not including income tax), the interest cost on debt, dividends (if any) and make provision for future assets refurbishment/ replacement, Dividends should be set at a level that reflects commercial realities and stimulates a competitive market outcome.' (Natural Resource Management Ministerial Council [NRMMC] 2010, p. 18)*

And to avoid monopoly rents, the upper bound pricing should be followed where,

> *'a water business should not recover more than the operational, maintenance and administrative costs, externalities, taxes or TERs [tax equivalent regime], provision for the cost of asset consumption and cost of capital, the latter being calculated using a WACC [weighted average cost of capital]. (NRMMC 2010, p. 18)*

Water pricing principles emphasise cost recovery elements, such as the costs of running and operating water activities. While there is mention of externalities and their inclusion for setting urban taxes, there is no definition for what externalities are and how they are calculated to be incorporated in the costs. This point is discussed in the Regulatory Impact Statement of the NWI pricing principles (Department of the Environment, Water, Heritage and the Arts [DEWHA] 2010, p. 36). For example, climate change was cited to be an externality 'reducing catchment yields and leading to the use of higher cost water sources' (Local Government Association of Queensland cited in DEWHA 2010, p. 36). It was argued that there was no process for incorporating and determining externalities.

Other criticisms discussed the need for NWI pricing principles to place greater emphasis on the role of water in providing human needs. The Consumer Action Law Centre was concerned about 'no recognition of waters role in meeting fundamental human needs' whereas the Consumer Utilities Advocacy Centre was concerned that there was no reference to 'the need for water which is the most essential of all services to be affordable, nor is there any clear articulation of principles relating to equity or accessibility' (DEWHA 2010, p. 36). This suggested that pricing principles were narrow.

Food

The statutory marketing arrangements, a feature of government intervention in the agriculture sector, had a range of common objectives. These included to 'counter-veil the market power of merchants, processes and other intermediate buyers, stabilise prices, production and/or producer incomes, maximise returns from exports, provide information, develop markets and undertake research, obtain economies of size and scope in marketing, establish grade standards and quality controls and in general provide industry assistance' (IC 1991c).

A key component of statutory marketing arrangements were pricing schemes (domestic pricing arrangements and import controls), part of stabilisation schemes implemented in a number of rural industries particularly wheat, to protect farmers incomes. During the early periods pre-reform, food pricing was largely fixed and regulated. These schemes involved guaranteed prices, price equalisation which included two-price systems of a set home consumption price and an export price, and then later stabilised prices. According to Butlin, Barnard and Pincus (1982, p. 244) arrangements were characterised by high domestic prices as a result of tariffs, the dumping of exports on world markets and the pooling of proceeds to be distributed to producers.

One example of regulated pricing was seen in the Wheat Stabilisation Act 1948. This involved firstly a guaranteed price for wheat grown and delivered by wheat growers, calculated based on an index of product costs for each season, reviewed by the Wheat Cost of Production Committee. A Stabilisation Fund was created as a means of a tax on wheat exports to meet guaranteed prices. When export prices were higher than the guaranteed price, taxes were paid to the fund, and when prices were lower than guaranteed prices, money from the fund would be paid to farmers (ABS 1949, 1976).

Pricing schemes, however, were a burden on the government, particularly when the prices were attached to the costs of production and when export prices were below costs. Meaning that governments continued to unsustainably support farmers through subsidies with no incentive for them to reduce costs. Such issue brought upon the need to question levels of assistance, eventually leading to agricultural reforms that sought to reduce such assistance levels, and move pricing towards competitive pricing.

Since agricultural reforms, during the 1970s, food pricing has become market-based. The price for food items have been largely exposed to competition with little or no price regulation. Prices vary across the supply chain and are driven by demand and supply factors (Rural Industries Research and Development Corporation 2016). Table L2 lists the food prices according to the supply chain.

Table L2. Food Pricing

FOOD PRICE	DESCRIPTION

Farm gate price – farm production	Net price paid to the primary producer after the deduction of costs to get produce to market
Factory gate price	Gross price paid to the primary producer based on the value to the buyer at the factor or market location
Wholesale price	Price paid for goods at the point where they enter the retail distribution sector
Back of Store Price	Price paid by a retailer at the point of delivery to the retail business
Retail Price	Price paid by a consumer for an item at the retail point of sale.
Import Price	Price paid by an Australian buyer for products which land at a point of sale and enter the domestic supply chain
Exported price	Price paid by an export customer to an Australian supplier when title changes to that buyer – generally at an Australian port

Source: Adapted from Rural Industries Research and Development Corporation (2016)

Pricing processes for EWF during the early developments were a means of achieving development objectives rather than allocating resources. For example, during the early developments of water, control of water use were through other means than price, water rates were considered taxes for urban users, and water licences for rural users were to encourage their use of water. In the energy (electricity) sector, government incentives were to encourage electricity use, in a way that private sector could not, as governments could rely on their budgets (Butlin, Barnard & Pincus 1982, p. 244). In the agricultural sector, pricing schemes were to protect farmers' incomes rather than ensure the efficiency of land use and rural production.

Changes to pricing processes associated with EWF were an important aspect of economic reforms in these sectors. For energy, prices were a concern because of the monopoly power of utilities in transmission networks and gas pipelines. For water, criticisms were that water prices were low and contributing to the overuse of water and the insufficient investment of infrastructure and the insufficient recovery of costs. For food, continued financial support to farmers encouraged inefficiencies and dependencies. After reforms and under the influence of neoliberalist ideas, the pricing processes introduced aimed to ensure efficiency.

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