The Eye of the Storm

An Integral Perspective on Sustainable Development and Climate Change Response

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Candidate

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Relevant Publications

Some of the research reported in this thesis was originally published elsewhere. I have listed relevant research publications arising from my PhD research below.

Refereed Publications

Riedy, C 2002, 'Business as Usual in the Australian Energy Sector: Utopia in Disguise', *Proceedings of the Environmental Engineering Research Event 2002*, Blackheath, NSW, 3-6 December 2002.

Riedy, C 2003, 'A Framework for Economic Analysis of Greenhouse Abatement Options', *Proceedings of the 2003 National Workshop of the Economics and Environment Network*, Canberra, ACT, 2-3 May 2003, http://een.anu.edu.au/workshop.html

Riedy, C and Diesendorf, M 2003, 'Financial Subsidies and Incentives to the Australian Fossil Fuel Industry', *Energy Policy*, 31 (2), pp.125-137.

Riedy, C 2004, 'Vintage Stock Modelling of Domestic Appliances: Dealing With Uncertainties', in P Bertoldi, F Conti & R Pagani (eds), *Energy Efficiency in Domestic Appliances and Lighting: Proceedings of the 3rd International Conference on Energy Efficiency in Domestic Appliances and Lighting*, Part 2, Softech, Turin, Italy, pp. 697-710.

White, S, Milne, G & Riedy, C 2004, 'End Use Analysis: Issues and Lessons', *Water Science and Technology: Water Supply*, 4 (3), pp.57-65.

Saddler, H, Riedy, C & Passey, R 2004, *Geosequestration: What is it and How Much can it Contribute to a Sustainable Energy Policy for Australia?*, Discussion Paper Number 72, The Australia Institute, Canberra, September.

Conference Papers – Abstract Refereed

Riedy, C 2001, 'Using Backcasting to Identify Sustainable Futures', In: *Proceedings of 3rd Annual UTS Students' Association & University Graduate School Postgraduate Research Students' Conference*, Sydney, NSW, 17 August 2001.

Riedy, C 2002, 'Government Subsidies to the Australian Fossil Fuel Industry', *Australia and New Zealand Society for Ecological Economics 2002 Conference on Ecologically Sustainable Development*, Sydney, NSW, 2-3 December 2002.

White, S, Milne, G & Riedy, C 2003, 'End Use Analysis: Issues and Lessons', *Efficient 2003: Efficient Use and Management of Water for Urban Supply Conference*, Tenerife, Canary Islands, 2-4 April 2003.

Riedy, C 2003, 'A Deeper and Wider Understanding of Sustainable Development', *Ecopolitics XIV Conference: Greening Sustainability*, Melbourne, Victoria, 27-29 November 2003.

Riedy, C 2004, 'A Developmental Perspective on Climate Policy Discourse', *5th Asia-Pacific Rim Universities Doctoral Students Conference*, Sydney, 9-13 August 2004.

Preface

This is a thesis in sustainable futures. Sustainable development and the future are topics that cut across traditional disciplinary boundaries. There is much overlap between the sustainable development literature and the futures literature; the concept of sustainable development is explicitly long-term and future-oriented, and most explorations of the future are committed to sustaining human civilisation. The marriage of these two concepts and literatures in the term **sustainable futures** is a natural one. Sustainable and desirable futures will require action by people from all disciplinary backgrounds, all walks of life. Integration and synthesis of specialist disciplinary knowledge that is presently compartmentalised is a central challenge for researchers interested in sustainable and desirable futures. In this thesis, I attempt integration and synthesis of work from diverse fields related to sustainability.

This thesis is also intended as an example of integral futures work. Futures work in general, and integral futures work particularly, draws on numerous disciplines to explore the implications of probable, possible and preferable futures. Therefore, as an integral futures perspective on sustainable development, this thesis is unavoidably and unashamedly cross-disciplinary.

A cross-disciplinary thesis asks more of the reader, and ranges more widely, than a traditional PhD thesis. It may introduce the reader to disciplines with which they are not familiar, challenging them to understand not just new material, but new ways of thinking about or approaching reality. To help the reader to engage with these new disciplines, a cross-disciplinary thesis may include more introductory material, and assume less knowledge. As a result, some sections of this thesis may seem basic to the reader who is familiar with that discipline, while others may pose more of a challenge. I hope that the insights provided by a cross-disciplinary and integral approach outweigh the challenges to the reader. Nevertheless, I ask for your patience with material that is unfamiliar or too familiar.

When I began the research reported in this thesis I was not familiar with integral philosophy, let alone the emerging applications of this philosophy to futures work and many other fields, from ecology, to politics, to art, to sustainable development. The original intent of my research was to develop energy and greenhouse response scenarios for Australia using backcasting, systems theory and spreadsheet modelling, over the period 2000 to 2030. I hoped to identify technically and economically feasible pathways to achieve a 50 per cent reduction in Australia's energy-related greenhouse gas emissions by 2030. The resulting scenarios would provide images of a sustainable energy future to challenge the unsustainable futures promoted by Australian governments and businesses.

As an environmental engineer, trained primarily in science and mathematics, I initially approached the research as a difficult modelling exercise, requiring a long period of data collection and analysis. However, after reviewing the diverse literature on the study of the future, I came to question the value of such a modelling exercise. Specifically, I became aware of the crucial role of subjectivity in our perceptions of the future. Any scenario I created, no matter how detailed, would only serve to project my particular values, and perhaps those of other research participants, into the future. It seemed to me that this would do little to influence those who were committed to existing energy and greenhouse policies, as their values appeared quite different to my own. This realisation led to something of a crisis in the research, where I questioned the value of continuing.

Fortuitously, around this time, I discovered the work of Ken Wilber and the emerging field I have called **integral theory** in this thesis. I also discovered Richard Slaughter's specific application of integral theory to futures studies. Integral theory provided an explanation for the crisis in my research, and offered a way forward. After reading Wilber's *A Brief History of Everything*, I realised that my original research proposal was trapped in the 'flatland' he describes.[1] My proposed modelling exercise would provide a useful objective map of the types of technological and economic development required to substantially reduce Australia's greenhouse gas emissions. But this map would ignore the crucial role of subjective values in determining the shape of the future. It would be a map with no depth, uninformed by an understanding of the interior transformations required to bring about a sustainable energy future. I began to realise that a truly holistic and sustainable approach to development had to consider both exterior and interior development.

With this realisation, my research began to take a very different shape. My grounding in the social sciences and my understanding of subjectivity was not sufficient to allow an immediate switch to an integral perspective. Indeed, it took at least a year for the implications of Wilber's writing for my research to become clear and another year before I began to think of my work as an attempt to apply an integral approach. However, having realised the inherent limitations of my research, I could not be satisfied unless I attempted a more integral approach, sensitive to both the objective and the subjective. As Wilber puts it: 'I don't know of any intelligent person who, after studying and grasping the integral overview, chooses a narrower alternative' (Wilber 2004, p.xi).

I hope that the resulting thesis makes a useful contribution to the development of integral studies as a valid field of academic inquiry and helps to demonstrate that sustainable development must be both objective and subjective. There is much to gain from dialogue between integral theorists, futurists and advocates of sustainable development. I look forward to participating in this ongoing conversation.

Christopher Riedy
November 2004, Sydney, Australia

[1] Flatland is Wilber's term for a world of surfaces, without any depth or meaning, obsessed with objective exteriors and ignorant of subjective interiors. For more on flatland, see Section 2.4.4.

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Abbreviations and units

4WD	Four-wheel drive
ABARE	Australian Bureau of Agricultural and Resource Economics
ABC	Australian Broadcasting Corporation
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ACF	Australian Conservation Foundation
ACIS	Automotive Competitiveness & Investment Scheme
AGC	The Allen Consulting Group
ACRE	Australian CRC for Renewable Energy
AEMC	Australian Energy Market Commission
AEC	Annual energy consumption
AER	Australian Energy Regulator
AFCF	Alternative Fuels Conversion Program
AGO	Australian Greenhouse Office
APPEA	Australian Petroleum Production and Exploration Association
AQAL	All-quadrants, all-levels
ASPO	Association for the Study of Peak Oil
ATSE	Academy of Technological Sciences and Engineering
BASIX	Building Sustainability Index (NSW)
BCSE	Business Council for Sustainable Energy
BTE	Bureau of Transport Economics
C&C	Contraction and convergence
CANA	Climate Action Network Australia
CBD	Central business district
CBSR	Colmar Brunton Social Research
CCS	Carbon capture and sequestration
CDM	Clean Development Mechanism (part of the Kyoto Protocol)
CFCs	Chlorofluorocarbons
CFS	Critical futures studies
CGE	Computable general equilibrium
CH_4	Methane
CHP	Combined heat and power
CIRA	Center for Integrated Regional Assessment
CLA	Causal layered analysis
CNG	Compressed natural gas
CO	Carbon monoxide

CO_2	Carbon dioxide
CO_2CRC	CRC for Greenhouse Gas Technologies
COAG	Council of Australian Governments
COOL	Climate Options for the Long Term
COP	Conference of the Parties
CRC	Cooperative Research Centre
CSD	(United Nations) Commission on Sustainable Development
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFGS	Diesel and Alternative Fuels Grants Scheme
DEC	Department of Environment and Conservation (NSW)
DECADE	Domestic Equipment and Carbon Dioxide Emissions
DEH	Department for Environment and Heritage (Commonwealth)
DEUS	Department of Energy, Utilities and Sustainability (NSW)
DFAT	Department of Foreign Affairs and Trade (Commonwealth)
DG	Distributed generation
DITR	Department of Industry, Tourism and Resources (Commonwealth)
DNDE	Department of National Development and Energy
DNSP	Distribution network service provider
DOE	Department of Energy (US)
DPIE	Department of Primary Industries and Energy
DRE	Department of Resources and Energy
E2WG	Energy Efficiency Working Group
ECI	Environmental Change Institute (Oxford University)
ECITA	Environment, Communications, Information Technology and the Arts (Committee)
EES	Energy Efficient Strategies
EGCS	Energy Grants Credits Scheme
ES	Energy Strategies
ESAA	Energy Supply Association of Australia
ESD	Ecologically sustainable development
FAR	First Assessment Report (IPCC)
FBT	Fringe Benefits Tax
FCCC	Framework Convention on Climate Change
FEC	Final energy consumption
FF	Fossil fuel
FS	Futures studies
FSGS	Fuel Sales Grants Scheme
GCI	Global Commons Institute
GCM	General Circulation Model

GDP	Gross domestic product
GHG	Greenhouse gas
GNP	Gross national product
GRI	Global Reporting Initiative
GSP	Gross state product
GST	Goods and Services Tax
Gt	Gigatonnes
GtC	Gigatonnes of carbon
GWA	George Wilkenfeld & Associates
GWh	Gigawatt hours
HCFC	Hydrochlorofluorocarbon
HF_6	Sulphur hexafluoride
HFC	Hydrofluorocarbon
IA	Integrated assessment
IAP	Integrated abatement planning
IAP2	International Association for Public Participation
IEA	International Energy Agency
IGCC	Integrated gasification combined cycle
IPART	Independent Pricing and Regulatory Tribunal of NSW
IPCC	Intergovernmental Panel on Climate Change
IRP	Integrated resource planning
KP	Kyoto Protocol
LBNL	Lawrence Berkeley National Laboratory (US)
LCA	Life cycle assessment
LCP	Least cost planning
LCT	Luxury Car Tax
LCV	Light commercial vehicle
LETAG	Lower Emissions Technology Advisory Group
LETDF	Low Emissions Technology Demonstration Fund
LL	Lower-Left (cultural quadrant)
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
LR	Lower-Right (social quadrant)
MCE	Ministerial Council on Energy
MCMPR	Ministerial Council on Mineral and Petroleum Resources
MEFL	Moreland Energy Foundation Limited
MEPS	Minimum energy performance standards
MIPS	Material input per unit service

MMA	McLennan Magasanik Associates
MFP	Major Projects Facilitation
MRET	Mandatory renewable energy target
Mt CO_2-e	Megatonnes of carbon dioxide equivalent
MW	Megawatts
N_2O	Nitrous oxide
NAEEEC	National Appliance and Equipment Energy Efficiency Committee
NAEEEP	National Appliance and Equipment Energy Efficiency Program
NCSD	National Council for Sustainable Development
NEC	National Electricity Code
NECA	National Electricity Code Authority
NECF	National Environmental Consultative Forum
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NFEE	National Framework for Energy Efficiency
NGAC	NSW Greenhouse Abatement Certificate
NGO	Non-government organisation
NGRS	National Greenhouse Response Strategy (1992)
NGS	National Greenhouse Strategy (1998)
NO_x	Oxides of nitrogen
NSW	New South Wales
NTC	National Transport Commission
O_3	Ozone
OECD	Organisation for Economic Cooperation and Development
ORER	Office of the Renewable Energy Regulator
OSL	Ownership/service life (a type of vintage stock model)
PEC	Primary energy consumption
PFC	Perfluorocarbon
PIAC	Public Interest Advocacy Centre
PJ	Petajoules
PMV	Passenger motor vehicle
ppmv	Parts per million by volume
PPP	Purchasing power parity
PRRT	Petroleum Resource Rent Tax
PV	Photovoltaic
R&D	Research and development
RA	Redsuit Advertising
RAF	Retirement adjustment factor

RCEP	Royal Commission on Environmental Pollution (UK)
RE	Renewable energy
REC	Renewable Energy Certificate
SAR	Second Assessment Report (IPCC)
SCO	Standing Committee of Officials
SEAC	State of the Environment Advisory Council (Australia)
SEAV	Sustainable Energy Authority Victoria
SEDA	Sustainable Energy Development Authority (NSW)
SESSWG	Strategic Energy Supply and Security Working Group
SRES	Special Report on Emissions Scenarios (IPCC)
TAI	The Australia Institute
TAR	Third Assessment Report (IPCC)
TBL	Triple bottom line
TEC	Total Environment Centre
TES	Tax Expenditures Statement
TIC	Techno-Institutional Complex
TNSP	Transmission network service provider
UCAP	Utilities Consumer Advocacy Project
UEC	Unit energy consumption
UK	United Kingdom
UL	Upper-Left (intentional quadrant)
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UR	Upper-Right (behavioural quadrant)
US	United States of America
W/m^2	Watts per square metre
WCED	World Commission on Environment and Development
WMO	World Meteorological Organization
WSSD	World Summit on Sustainable Development (held in Johannesburg, 2002)
WST	Wholesale Sales Tax
WWF	Acronym originally derived from World Wildlife Fund, later redefined as World Wide Fund for Nature, and now used as an actual name

Abstract

In this thesis, I explore the implications of integral theory for sustainable development and climate change response. Integral theory seeks to integrate objective and subjective perspectives using a developmental orientation. It addresses issues of subjectivity that have received inadequate attention in mainstream approaches to sustainable development, while also providing theoretical grounding for the developmental aspect of sustainable development. According to integral theory, there are four main epistemological approaches to any problem: behavioural, systemic, psychological and cultural. The first is objective and individual, the second objective and collective, the third subjective and individual and the fourth subjective and collective. Development occurs within each of these realms.

To test the value and implications of integral theory for sustainable development, I adopt a case study on climate change response in Australia. I begin the case study by using the four perspectives of integral theory to guide a review of the energy and climate change literature. I follow the literature review with a critical review of Australian energy and greenhouse policy, providing the starting point for development of an integral climate change response. While there is attention to subjectivity in the literature, it is not reflected in Australian policy practices. An objective perspective and an instrumental form of rationality dominate policy.

In the literature review, I identify two gaps in the literature that deserve attention. The first is the role of public subsidies in creating the observed cost differential between renewable energy sources and fossil fuel energy. I examine the relative magnitude of subsidies to fossil fuels and renewable energy in the Australian energy and transport sectors and conclude that the distribution of these subsidies distorts the market in favour of fossil fuels, particularly in the transport sector. The second is the application of a developmental perspective to cultural theories of climate policy discourse. I introduce a method called meta-discourse analysis to identify consistencies and relationships across discourse descriptions by different authors and demonstrate that aspects of each discourse can be related developmentally.

Drawing on the literature review, policy review and other work, I propose an integral policy response to climate change that could be applied in Australia. The policy response combines participatory integrated assessment, normative futures work, a modified version of the cooperative discourse model for public participation, an evolutionary policy orientation and several methods to promote subjective development. The proposed policy approach should be equally applicable to other sustainable development issues.

1. Framing an Inquiry into Sustainable Futures

> The bombs, the massacre of innocents, the turning of people against their own kind and their world, will continue. The environmental news will worsen. Coral reefs may disappear, forests shrink to remnants. We will lose many more species and currently fertile areas will become deserts, like others throughout history. Overall, the erosion of the ecological foundations of life will continue unabated.
>
> \- Richard A. Slaughter, *Futures Beyond Dystopia*, pp.5-6

> If you want something really important to be done you must not merely satisfy the reason, you must move the heart also.
>
> \- Mahatma Gandhi

1.1 Introduction

In this introductory chapter, I consider the purpose of a doctoral thesis in sustainable futures and establish broad research objectives and specific research questions to guide my research. I start, in Section 1.2, by providing a brief overview of some of the environmental and social challenges with which humanity is faced in the 21st century. These challenges have been exhaustively catalogued elsewhere; my overview here is meant mainly as a reminder of what is at stake when researching sustainable futures.

I use this overview to establish some broad research aims – far too broad for a single doctoral thesis. My task in the remainder of the chapter is to translate these broad aims into specific research questions that are amenable to further analysis. I begin this task in Section 1.3, by exploring the meaning of sustainable futures and implications for research. In Sections 1.4 and 1.5, I link my research to current concerns in the sustainable development and futures literature. Then, in Section 1.6, I outline a conceptual framework for the remainder of the thesis. Section 1.6.4 sets out my research questions and provides a brief summary of the remainder of the thesis, using the research questions as a guide.

My main method in this chapter is literature review, supplemented by some theoretical critique and argument. I do not specifically address the question of methodology in this chapter. Instead, Chapter 2 addresses methodology in considerable detail.

1.2 Challenges for humanity in the 21st century

The environmental and social challenges to human civilisation early in the 21st century are well documented in books, reports and newspaper articles too numerous to catalogue. In this section, I provide a brief sketch of some of these challenges to set the scene for my research. I start by considering the emergence of modern environmentalism, and the way that the concerns of environmentalists have been enfolded into the discourse of sustainable development.

1.2.1 From environmentalism to sustainable development

Concern about the environmental impacts of human civilisation has a long history, dating back at least as far as the Romantic Movement that emerged in response to the Industrial Revolution (Guha 2000, pp.3-4). From the late eighteenth century onwards, industrialisation and economic development, coupled with human population growth, greatly increased demand for environmental resources and for disposal of industrial wastes, with consequent impacts on the integrity of ecological systems and the quality of life in industrial cities. The European Romantics responded by elegising nature, romanticising the landscapes that were so evidently threatened by industrialisation.

However, the Romantic Movement was never more than an elite intellectual concern, and environmental concern remained rare well into the 20th century. It was only in the 1960s that a recognisable environmental movement began to achieve widespread public support and to have a significant influence on public policy (Guha 2000, p.3). The birth of modern environmentalism is typically linked to the publication in 1962 of *Silent Spring* (Carson 1962), which drew public attention to the ecological impact of agricultural chemicals, particularly on bird life. In Australia, the country that is the subject of my research, modern environmentalism emerged through the development of an earlier conservation movement, devoted to preservation of scenic places, into a political movement (Mulligan & Hill 2001). The campaigns to prevent dam construction in the Tasmanian wilderness in the 1970s and early 1980s were pivotal events in the politicisation and mainstream acceptance of the Australian environmental movement (Mulligan & Hill 2001).

Environmentalism in the early 21st century is a diverse social movement with many strands, varieties and types. For example, in his global history of environmentalism, Guha (2000) identifies three generic modes of environmentalism, respectively focused on a romantic 'back-to-the-land' ideal, a scientific approach to conservation and a wilderness ethic. Pepper (1996, pp.34-46) reviews several typologies that categorise strands of environmentalism according to the value they place on humans and nature, and their political commitments. Dryzek (1997) identifies four distinct categories of environmental discourse, corresponding to very different types of environmentalism: survivalism, problem solving, sustainability and green radicalism. Despite this diversity, environmentalism is still a recognisable movement, unified by an argument that the ecological impact of human civilisation is problematic, and that some sort of social, political or individual response is required.

Environmentalism has achieved much over its forty-year history. Working primarily as a protest and lobbying movement, it has prevented many developments perceived to have an unacceptable impact on the environment, won the protection of numerous areas with high conservation significance and helped to generate a wealth of knowledge about ecological systems. Further, Dryzek (1997) shows that environmentalism has significantly influenced the nature of political, economic and social institutions, generally advancing the cause of democracy.

However, despite its undoubted achievements, environmentalism is a movement that is often plagued by negativity. Environmentalism is typically reactionary, arguing *against* undesirable development rather than *for* concrete alternatives. As such, it fails to address difficult questions about how economic and social objectives should be balanced, or traded off, against ecological objectives. Further, environmentalism is underpinned by dire warnings and forecasts of ecological doom and destruction (e.g. Meadows et al 1972) that, at times, serve to paralyse action and foster apathy. According to Zimmerman (2003, p.10), 'the emotion of fear and the mood of despair prove ineffective in marshalling energy in a social movement' causing people 'instead to withdraw into their personal lives as part of a strategy of denial'. If things are really as bad as environmentalists claim, then what can an ordinary citizen do to make a difference?

Recognising these problems, many concerned about the environmental impacts of human civilisation have embraced the concept, or discourse, of sustainable development as a natural successor to environmentalism. The sustainable development discourse, which emerged during the 1980s (Robinson 2004, p.370), provided a language to move beyond the 'apocalyptic tones, the bad news that characterized so much of the environmental debate in the 1960s and 1970s' (Jamison 2000, p.249).[2] The rhetoric of sustainable development promises solutions to environmental problems without compromising economic development or social justice. This positive message is far more attractive to business, governments and the general public than the doom and gloom that often pervades the environmental movement. It is little wonder, then, that sustainable development has become the 'dominant global discourse of ecological concern' (Dryzek 1997, p.123) – the conceptual territory in which environmental issues are framed.

Importantly, the discourse of sustainable development has drawn many whose primary concern is not environmental protection. In fact, the "Brundtland Report" (WCED 1987), credited with popularising sustainable development, emphasised economic growth and development, particularly in developing countries, over environmental concerns. As a result, many economists are quite

[2] Although it is fair to say that the concept of sustainable development emerged in the 1980s, the concept built on several earlier precursors. These precursors include some religious teachings, the economic theory of limits proposed by Malthus ([1798] 2003), anarchist thought and the concept of appropriate technology (Mebratu 1998).

comfortable with the concept of sustainable development, although they may understand it in very different terms to environmentalists. Others place particular emphasis on the social dimensions of sustainable development, including equity, justice and human rights.

These diverse interests have contributed to the mainstream understanding of sustainable development as the task of balancing economic development with environmental protection and social equity (see, for example, paragraph 5 of United Nations 2002b). The concerns of sustainable development are broader than those of environmentalism, encompassing allocation of resources, intragenerational and intergenerational equity, and democratic participation.

Some environmentalists reject the idea of sustainable development altogether, arguing that the term is used hypocritically to foster the illusion of environmental protection and hide an abiding commitment to unfettered economic growth (Purser 1997; Robinson 2004). Environmentalists have also criticised sustainable development for its anthropocentrism and its analytical vagueness (Cohen et al 1998; Mebratu 1998; Robinson 2004). Nevertheless, sustainable development has become so dominant as a way of framing environmental issues (Mebratu 1998, p.502) that few environmentalists can escape at least some engagement with the discourse.

In Australia, the transition from environmentalism to sustainable development took a very public form. In 1990, the Labor Government under Prime Minister Bob Hawke established an ecologically sustainable development (ESD) policy process to develop a National ESD Strategy (see Hamilton & Throsby 1998). The process established working groups in several topic areas, such as energy, forests and mining. The working groups, which included scientists and representatives from national environmental groups, industry associations, government departments, unions and consumer groups, were asked to define and articulate sustainable development. Illustrating the tension between the broader objectives of sustainable development and those of some environmentalists, the Wilderness Society and Greenpeace withdrew from the working groups, citing dissatisfaction with government environmental policies and the direction taken by the ESD process. Other environmental groups, including the Australian Conservation Foundation and WWF Australia, chose to work within the policy process. Although an ESD strategy was successfully developed, a change of government meant that few of its recommendations were implemented (Dryzek 1997; Hamilton & Throsby 1998).

Difficulties in translating the rhetoric of sustainable development into reality are by no means limited to the Australian ESD process. Dryzek (1997) notes that, internationally, very few concrete examples of sustainable development have made their way into political, economic and social institutions. While additional examples of sustainable development in practice have emerged since Dryzek wrote (e.g. Azapagic, Perdan & Clift 2004; McDonough & Braungart 2002), it remains true that, in absolute terms, many environmental trends have worsened since modern environmentalism emerged, and the rhetorical embrace of sustainable development has done little to alter these trends (Mebratu 1998).

Globally, deforestation, desertification, biodiversity loss, land degradation and climate change all continue, often at an accelerating pace (see, for example, IPCC 2001d; UNEP 2002; World Resources Institute 2002; Worldwatch Institute 2002). In Australia, 'the state of the Australian natural environment has improved very little since 1996, and in some critical aspects, has worsened' (Australian State of the Environment Committee 2001, p.2). Around the Earth, the evidence continues to mount that ecological systems are unravelling under the stresses imposed by human civilisation. At the very least, these bleak environmental trends will leave the Earth sadly diminished as numerous species are driven to extinction. At worst, we could be one of those species.

1.2.2 The civilisational challenge

Meanwhile, humanity is faced with social and cultural trends that are just as alarming as the environmental trends. In 2000, there were 25 major armed conflicts in 23 countries around the world (World Resources Institute 2002, p.21). Since then, the rise of global terrorism and the so-called war on terrorism have brought new threats. While the prospect of warfare between the advanced industrialised nations has receded with the advent of economic globalisation, new types of global conflict continue to threaten the stability of human civilisation. The continued existence of weapons of mass destruction serves to magnify this threat.

Widespread poverty and inequity, particularly in developing countries, fuels many of the global conflicts and creates conditions in which terrorism flourishes. According to United Nations definitions, people are living below the poverty line if their income is less than one United States dollar per day, measured at purchasing power parity (PPP). In 1999, about 1.2 billion people, or 20 per cent of the global population, met this definition (United Nations 2003). Statistics on life expectancy, literacy, prevalence of disease, access to health care, nutrition, infant mortality, and many other aspects of human development reveal vast inequities between developed and developing nations (UNDP 2003). Inequity is also prevalent within nations.

In developed countries, despite historically unprecedented levels of material wealth, meaning and happiness remain elusive (Hamilton 2003; Kahneman 2003). Images of dystopian 'futures overwhelmed by technology' (Slaughter 2002c, p.352) proliferate in the scientific literature and popular media (e.g. Joy 2000). These images raise the possibility of futures where new forms of technology, such as biotechnology, nanotechnology or artificial intelligence, escape human control and threaten human existence. For many, the bright promise of economic growth and technological development does not seem to match the reality. As Slaughter (1998b, p.519) puts it:

> Those of us who live in the late 20th century cannot but be aware of the great schisms in our midst: islands of affluence in seas of poverty and despair; technical virtuosity amid global pollution and species extinctions; profound insight into the structure of the universe contrasted with a nihilistic, often angry

> pop culture endlessly lost in its own hostility and fear. In other words, this is a time of great polarities and severe contradictions.

Slaughter (2002c) calls the combination of these various bleak trends, including the environmental trends discussed in Section 1.2.1, the 'civilisational challenge'.[3] This challenge has been evident for some time. In 1992, the United Nations (UN) Conference on Environment and Development (the Earth Summit) succinctly summarised this challenge in the opening lines of *Agenda 21*, a plan of action for sustainable development:

> Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being (United Nations 1992a, Article 1.1).

While *Agenda 21* subsequently identified the possibility of sustainable development as the way forward, after reviewing current trends it is difficult to avoid the conclusion that, despite growing awareness of the parlous state of the world, the civilisational challenge continues to grow. Progress towards a sustainable and desirable future is painfully slow and lacks the urgency that existing trends seem to justify. There is certainly no shortage of information on the details of the civilisational challenge, yet this wealth of information has not led to a significant change in behavioural practices.

In this thesis, I ask 'why?' After four decades of modern environmentalism, succeeded by the concept of sustainable development, why has there been so little progress towards a sustainable and desirable human civilisation? Why is the state of the world so bleak, from so many perspectives? Is there something missing from the concept of sustainable development that limits its success in reversing negative environmental and social trends? Is it possible to improve the concept of sustainable development to address these limitations? If so, how would such a concept translate into concrete policies and actions for governments, organisations and citizens?

These questions, of course, are far too broad for a single doctoral thesis. In the next section I start to narrow these questions by exploring the meaning of sustainable futures and my personal perspective on the type of future that is desirable.

1.3 What are sustainable futures?

An inquiry into sustainable futures has no obvious disciplinary home. It can be approached in many different ways, from many different perspectives. To provide some guidance on the appropriate approach, I will start by considering what sustainable futures might mean, first broadly, and then personally.

[3] Slaughter uses the term **civilisational** to capture the idea that the challenge is an all-encompassing one, faced by all people, nations and cultures, i.e. all members of human civilisation or human society. Equally, it requires a civilisational response – a simultaneous (albeit heterogeneous) response by all people, nations and cultures. I employ the term in the same way as Slaughter in this thesis.

1.3.1 Definitions and the crucial role of values

According to the Macquarie Concise Dictionary (*Macquarie Concise Dictionary* 1998), to sustain is 'to keep up or keep going, as an action or process'. Literally then, a sustainable future is a future that keeps going. This literal definition is not particularly useful. The future will continue to unfold until the end of the universe, and perhaps beyond, regardless of whether humans still exist. On timescales of interest to humans, the future is always sustainable, although it may not be desirable.

Clearly, what is missing from the literal definition is a statement of values. Most people do not value dystopias – futures in which human civilisation ceases to exist, or struggles on in 'a world that is stripped, mined out, polluted, denuded of non-human life and compromised beyond all hope of repair' (Slaughter 2004, p.xxi). When people describe a sustainable future as an objective, they are really seeking the maintenance of human civilisation, based on some desirable set of values and social conditions, into the distant future. Strictly speaking, it is not a sustainable future that I am concerned with in this thesis, but a sustainable, desirable and flourishing human civilisation *in* the future.

Although this distinction may seem pedantic, it is important for highlighting the crucial role of values in any inquiry into sustainable futures. It is possible that the future civilisation that I desire may be very different to the future civilisation that you desire. If people value different futures, they may be thinking of very different things when they talk about sustainability, sustainable development or sustainable futures. Postmodernists argue that values and perspectives *do* vary subjectively and that these perspectives are all equally valid.[4] If values and perspectives vary, and I agree that they do, then a consensus definition of a sustainable future is impossible. An individual will construct, and defend, a definition that reflects his or her values, political perspective and philosophical position (Mebratu 1998; Robinson 2004). I do not believe that this is cause for alarm. Indeed, I will argue in Chapter 8 that this contestation, or 'constructive ambiguity' (Robinson 2004, p.374), is desirable as a source of creativity, innovation and learning. Regardless, any inquiry into sustainable futures must find some way to consider the subjective variation of values and perspectives – the social and personal construction of shared and individual reality.

Any inquiry into sustainable futures must also take account of change – the *development* in sustainable development. Human civilisation, if it is to be sustained, must cope with dynamic internal and external pressures, from new technologies to natural disasters. What seemed sustainable yesterday may not be sustainable tomorrow. Each of us constantly adjusts our vision of a sustainable and desirable future in response to new knowledge, new contexts and new values. Further, human desires may be unbounded; once one desire is achieved, a new one takes its place. Consequently, I believe that a sustainable and desirable future is an ideal that can never be made real. It is a vision that always recedes into the horizon – a mirage that drives us on.

[4] See Section 2.2.1 for further discussion of the postmodern perspective.

If a sustainable and desirable future is an ever-receding goal, then it is natural to focus attention on the journey towards that goal – sustainable development. As Bossel (1999, p.1) puts it: 'Sustainability in an evolving world can only mean sustainable development'. Sustainable development is a dynamic process of continual adaptation to a changing natural and social environment, driven by changing values and desires, but ultimately concerned with creating a better future. Of course, as already noted, the subjective nature of values and desires means that there are many different perspectives on sustainable development. It is therefore important that I outline my own values before proceeding.

1.3.2 A personal perspective on sustainable futures

An implication of the above discussion is that no purely objective analysis of sustainable futures is possible. Subjective values will always influence the type of future that each advocate of sustainable development is trying to create. This means that the scientific ideal of a detached researcher is unattainable for an inquiry into sustainable futures. If detachment is impossible, I concur with Jamison (2000, pp.261-262), who argues that creative intellectual engagement with personal values and normative attachments can strengthen research. Instead of trying to suppress subjectivity, researchers should make their values explicit, allowing their conclusions to be judged in the appropriate context. This type of analysis is complex (Inayatullah 2002b, p.298), but it has the potential to generate new types of insight and to strengthen the foundations of our research.

It is in this spirit of transparency and engagement that I outline my personal perspective on sustainable futures in the sections below. Further, by clarifying my own values, I provide a stronger foundation for identifying the specific research questions that I am interested in addressing in this thesis. Although the focus in the sections below is on my own values I have, where appropriate, discussed how values might vary. I have used six questions about sustainable futures to structure my discussion:

- What should we sustain?
- Why should we sustain?
- For whom should we sustain?
- For how long should we sustain?
- How should we sustain?
- How can we be sure of sustainability?

What should we sustain?

I value a future in which human civilisation survives. While it would be going too far to claim that this is a universal value, I think it is reasonable to assume that the vast majority of humans share this value.[5] What else needs to survive if human civilisation is to survive? Bateson (1972, p.483) drew on evolutionary systems theory to argue, convincingly, that: 'The unit of survival is organism plus environment'. Humans, despite our unique abilities, are still organisms. Therefore, the long-term survival of human civilisation depends on the survival of a healthy and supportive external environment.

Ecological systems provide numerous support services to human civilisation. Plants in the forests and oceans provide the oxygen we need to breathe, the hydrological cycle provides fresh water, agricultural ecosystems provide us with food and clothing, and the climate system provides a relatively stable climate. Despite ongoing scientific and technological advances, the complex ecological systems that provide these ecosystem services remain poorly understood. There is little prospect of providing these ecosystem services artificially, as illustrated by the well-publicised problems experienced with Biosphere 2, an attempt to create an enclosed artificial biosphere (Marino & Odum 1999). From a purely utilitarian perspective, a sustainable future rests on the continued functionality of at least those natural systems that provide civilisational support services.

The continued existence of human civilisation also requires a degree of internal harmony. Threats from within human civilisation, whether technological, social or cultural, have just as much potential to destroy civilisation as an environmental imbalance. To be sustainable, a civilisation must have some degree of control over the deployment of technology, some way to resolve conflict that does not lead to widespread destruction and some method to identify and respond to internal threats. I also believe that a sustainable civilisation requires some means to ensure that all citizens can participate in the decisions that affect their lives. This belief stems partly from a philosophical commitment to authentic democracy and partly from an assumption that alienation from decision-making processes sows the seeds of conflict, which can threaten sustainability.

A sustainable human civilisation, then, is one that responds to internal and external threats effectively enough that it continues to exist. This implies an element of dynamism; human civilisation must change to become sustainable and must continue to change to meet new threats that come from without or within. As discussed earlier, a sustainable future is not a static endpoint but a dynamic goal that is continually revised. A dynamic civilisation cultivates diversity as a way of providing the resilience, flexibility and creativity to respond to change (Healy 2003, p.699). Diversity is a resource that provides the wealth of ideas and ways of knowing required to solve novel problems and adapt to changing circumstances. In a dynamic world, I believe that a

[5] The members of the Voluntary Human Extinction Movement (http://www.vhemt.org/) are notable exceptions, arguing that Earth's biosphere would be far better off without humans.

sustainable human civilisation must cultivate diversity and resilience to respond rapidly and appropriately to external threats and internal conflicts.

If a civilisation is to cultivate diversity, it must find ways for different people to coexist peacefully. I believe that a principle of intragenerational or social equity provides a foundation for the peaceful coexistence of diverse cultures and beliefs. A sustainable civilisation would value all people equally and seek to reduce material inequities, recognising that inequality is a major source of conflict that threatens sustainability. The principle of intragenerational equity is widely accepted in the sustainability literature (e.g. Diesendorf 1997; Robèrt et al 2002), appears in the futures literature (e.g. Boyle, Thomas & Wield 2000), and has had its philosophical basis thoroughly explored by, for example, Singer (2002). However, it is by no means a universally accepted principle, and is often neglected in practice even when accepted in principle. Nevertheless, it is an ideal that I value.

The principle of intragenerational equity, as usually expressed, is anthropocentric or humanistic. It is concerned with equality among humans. Some people value equity not only for humans, but also for non-human forms of life (e.g. Singer 1990). Many different reasons have been proposed for valuing nature, including the utilitarian arguments presented above, the moral arguments presented by Singer (1990) in his call for animal liberation and aesthetic and experiential arguments that focus on the existence value of nature. Personally, I believe that life has intrinsic value beyond its utilitarian value to humans and therefore advocate a sustainable human civilisation that protects biodiversity on moral and aesthetic grounds.

Why should we sustain?

The most immediate reason for pursuing sustainability is a natural concern with our personal survival and quality of life. The threats to sustainability may manifest as personal threats in our own lifetimes. Moving beyond the personal to the familial and social, many people might wish to sustain human civilisation for their children, grandchildren and distant descendants. Richard Dawkins famously argued, in *The Selfish Gene* (Dawkins 1990), that the desire to sustain human civilisation for our descendants is part of our genetic heritage. I would argue that there are also many non-genetic, cultural explanations for the desire to sustain human civilisation. Whatever the reasons, I believe that few people would wish to raise a child to inherit a doomed world.

The existence-value argument I discussed above is also relevant here. If life has intrinsic value, then that is all the reason we need to sustain human civilisation and other life on Earth. Some authors go further, arguing that humans, as the only example of intelligent life on the only planet known to harbour life, have a responsibility to take all possible action to ensure the continued existence of life into the distant future (e.g. Tonn 2002). Tonn argues that humans must eventually find ways to 'transcend oblivion' by taking life beyond the fragile confines of the Earth. This extremely long-term view is interesting, but I believe that current threats to biodiversity and human quality of life provide more than enough reasons to seek sustainability.

For whom should we sustain?

As discussed above, it is reasonable to assume that many people would prefer a future in which their descendants survive and thrive. The principle of intergenerational equity, widely considered to be a core principle of sustainable development, captures this preference. It is stated in Section 3A of Australia's *Environment Protection and Biodiversity Conservation Act 1999* as follows: 'the principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations'.

If we adhere to this principle, then we are sustaining human civilisation and natural systems for the benefit of future generations, as well as ourselves. Again, this is by no means a universal principle, as indicated by the prevalence of economic tools and methods that explicitly discount the future (see Section 4.10.2). However, it is a principle I value.

For how long should we sustain?

A commitment to the principle of intergenerational equity implies a desire to sustain human civilisation at least one generation into the future, perhaps two or three to encompass grandchildren and great-grandchildren born during one's lifetime. Robinson (2003, p.852) has found that many people 'care about a time frame that is roughly the working life of their children, or their own working life if they are too young to have children'. This is a period of about 40 years.

Others, like Tonn (2002), wish for human civilisation to be sustained perpetually. Brand (1999, p.9) argues eloquently for a philosophy of 'All of us for all of time'. He also phrases this philosophy in Zen Buddhist terms as 'infinite gratitude for the past, infinite service to the present, infinite responsibility to the future' (p.9). While we may well wish to embrace a goal of maintaining civilisation indefinitely, it is unrealistic to expect those of us alive today to anticipate all future conditions or future values; the future always brings surprises. However, the realisation of a sustainable human civilisation demands a long-term perspective. In analysing sustainable futures, a balance is necessary between this long-term perspective and the practical demands of the present.

In this thesis, I consciously avoid any attempt to speculate about the future beyond 2050, although some of the literature I review does consider more distant futures. In a time when it is rare to think ahead more than a handful of years, thinking through almost 50 years is ambitious enough. This period of just less than 50 years is within the expected lifetime of many people living today. It is long enough to achieve radical changes in the structure of civilisation, and short enough to allow realistic planning. Furthermore, the year 2050 has landmark significance – the middle of the 21st century.

How should we sustain?

Sustainable development is a contentious area, and it is the *development* in sustainable development that generates the most contention. The type of development that people think of when they use the term sustainable development varies widely. For some, it is economic development in the conventional sense; sustainable development then means sustained economic growth. This understanding is common when referring to the physical and economic development of developing countries (e.g. WCED 1987).

Others question 'whether "development", at least of the conventional kind, can ever be sustainable' (Boyle, Thomas & Wield 2000, p.221). They call for development in a broader sense than the economic or physical, incorporating personal, social, cultural and even spiritual development (Boyle, Thomas & Wield 2000). I concur with Boyle, Thomas and Wield; sustainable development will require changes in the structure of economic and technological systems, institutional changes, value changes and cultural changes. I will return to the nature of sustainable development in Chapter 2, and outline a theoretical model to support the position I advocate here.

How can we be sure of sustainability?

An inquiry into sustainable futures is plagued by uncertainty. A product, process, policy or action may seem sustainable, but we can never be certain that present knowledge captures all the possible impacts. Inayatullah (2003) points out that uncertainty increases as the temporal frame moves further into the future and the geographical frame moves further from the personal. This makes sustainable futures, which are long-term and involve all people and places, highly uncertain. Futurists and risk managers have developed methods to deal with uncertainty, such as the use of exploratory scenarios to map out possible futures. These methods can reduce uncertainty, but not remove it. The way the remaining uncertainty is addressed depends on how much risk an individual is prepared to accept. This will vary according to, among other things, their values, the context, their knowledge and their personal history (Adams 1995).

Based on my own personal risk assessment, I believe that the precautionary principle provides an ethical approach to uncertainty at the societal level. The precautionary principle is stated in Section 3A of Australia's *Environment Protection and Biodiversity Conservation Act 1999* as follows: 'if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'. That is, if the environmental or social impact of a proposed development is uncertain, it should not be up to opponents to prove that the development is unsustainable; rather, it should be up to the proponents to prove that it is sustainable. When uncertainty exists, precaution is required.

The precautionary principle is not universally accepted; some criticise it for stifling innovation, development, economic growth and progress (e.g. Morris 2000). I agree that precaution must be balanced with a willingness to experiment, innovate and learn. Otherwise, civilisation will stagnate. The point of the precautionary principle is not to caution against trying new approaches but to focus attention on the risks of things going wrong, and the severity of the consequences. We can never be entirely sure that what we are doing is sustainable, but we can better manage the risks by adopting a modicum of precaution.

1.4 The theory and practice of sustainable development

Having outlined my own perspective on sustainable futures, I now turn to the literature on sustainable development. Although an individual's understanding of sustainable futures will vary with his or her particular values, this does not mean that there is no common ground between individuals. Various disciplinary groups have reached their own mutual understanding, implicit or explicit, of what is meant by sustainable development. It is these shared theories and practices of sustainable development that I consider in this section.

The literature on sustainable development is diverse, ranging across many disciplines or fields of inquiry. Disciplines that have made particularly strong contributions to the sustainable development discourse include ecological economics, evolutionary systems theory, ecology and environmental science, philosophy, ethics, environmental history and political science, to name just a few. Sustainable development is an interdisciplinary concept that is not confined to any one of these disciplines; it draws on multiple disciplinary understandings, as appropriate.

I will not attempt to provide a comprehensive review of the sustainable development literature here.[6] Instead, my objective is to review some of the more popular conceptual approaches to sustainable development as a way of identifying current theoretical concerns and beginning to refine my research questions. I am also particularly interested in how my personal perspective on sustainable futures compares to those in the literature. Finally, given my earlier discussion of the influence of values on sustainable futures, I am interested in the different ways in which theories of sustainable development address subjectivity.

1.4.1 Sustainable development and the United Nations

The United Nations has played an important role in the emergence and widespread adoption of the concept of sustainable development. It was the UN Conference on the Human Environment, held in Stockholm, in 1972, that first explored the links between environment and development on a global scale (Mebratu 1998). In 1983, the UN established the World Commission on Environment and Development (WCED), chaired by Gro Harlem Brundtland, to examine environment and development issues and propose strategies to address them. The Brundtland Report, *Our Common*

[6] For those interested in a more comprehensive literature review, see Pezzoli (1997a; 1997b). For a useful conceptual overview, see Mebratu (1998).

Future (WCED 1987), was released in 1987. It is credited with popularising the term **sustainable development**. Its definition of sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED 1987, p.43) remains the most widely quoted definition of sustainable development today despite, or perhaps because of, its vagueness (Mebratu 1998).

One problematic aspect of the Brundtland definition is the ambiguity of 'needs'. Mebratu (1998, pp.504-505) identifies several institutional definitions of sustainable development, all focused on need satisfaction, that interpret needs very differently. The interpretation largely depends on the group that the institution represents, whether nation states, communities or corporations. The varying interpretations support advocacy of very different policies and practices. Numerous authors have argued, convincingly, that needs vary with context and values (e.g. Douglas et al 1998; Maslow [1954] 1987; Max-Neef 1991). If this is the case, then any concept of sustainable development based on needs simply encourages individuals and organisations to project their own values onto the concept. This, again, is the problem of subjectivity introduced in Section 1.3.1.

In 1992, the UN Conference on Environment and Development (the Earth Summit) in Rio de Janeiro continued to explore the concept of sustainable development. The Earth Summit adopted several international agreements, of which *Agenda 21* (United Nations 1992a) was arguably the most important for advancing understanding of sustainable development. *Agenda 21* is a comprehensive plan of action for sustainable development, containing 40 chapters of specific objectives and activities. It calls for 'integration of environment and development concerns[,]…the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future' (United Nations 1992a, Article 1.1). Developed through an international consensus-building process, involving representatives of national governments from around the world, *Agenda 21* provided a strong foundation for a shared understanding of sustainable development.

However, while *Agenda 21* outlined many specific objectives and actions, it did not establish any binding targets or commitments. Instead, it provided a conceptual framework under which international, national, regional and local organisations could develop their own detailed implementation plans. Consequently, the influence of *Agenda 21* has been varied. At the national level, implementation has generally been poor (UN Economic and Social Council 2001, pp.4-6). On the other hand, numerous local authorities have developed their own *Local Agenda 21* action plans. As of 2002, '6,416 local authorities in 113 countries [had] either made a formal commitment to Local Agenda 21 or [were] actively undertaking the process' (ICLEI 2002, p.3).

While there is much to applaud in *Agenda 21*, there is relatively little attention to the influence of subjective values on sustainable development. Much of *Agenda 21* focuses on concrete changes to economic, social and institutional structures and natural systems. Of the 40 chapters, only ten specifically refer to values in the context of sustainable development. References to values in these chapters are of two types. First, there are references to the need to respect 'personally held values' and 'ethical and cultural considerations' when undertaking sustainable development actions (United Nations 1992a, Article 3.8(j)). That is, *Agenda 21* recognises that different people and different cultures have different values. Second, there are references to the need to reinforce 'values that encourage sustainable consumption' (Article 4.27) and to 'strengthen attitudes, values and actions which are compatible with sustainable development' (Article 36.9). That is, *Agenda 21* recognises that sustainable development requires changes to existing values. I emphasised both these points in Section 1.3.1.

However, *Agenda 21* provides little specific direction on how to respect or change values, or how these two competing objectives might be balanced. Where it does consider ways to promote value change (e.g. Chapter 36 on Promoting Education, Public Awareness and Training), it adopts a simplistic educational model in which exposure to environmental education automatically cultivates ecological awareness and environmentally sensitive behaviour. Developmental theorists (e.g. Beck & Cowan 1996; Kahn 1999) have shown that ecological awareness is constructed through a long developmental process. Providing environmental education is useful, but is not in itself enough to create ecological awareness. I will return to this point in Chapter 2.

The United Nations Commission on Sustainable Development (CSD) was created in 1992 to ensure effective follow up of the Earth Summit and to report on implementation of the agreements developed at the Earth Summit, including *Agenda 21*. The CSD reviewed the implementation of *Agenda 21* in 1997 and endorsed its ongoing implementation. Implementation of *Agenda 21* was again reviewed at the United Nations World Summit on Sustainable Development (WSSD), held in Johannesburg, in 2002. The WSSD endorsed the actions contained in *Agenda 21* and the ongoing implementation of those actions (United Nations 2002c). It supplemented *Agenda 21* with the *Plan of Implementation of the World Summit on Sustainable Development* (United Nations 2002c) and the *Johannesburg Declaration on Sustainable Development* (United Nations 2002b).

The official documents on sustainable development agreed by the UN provide an overarching framework within which many other approaches to sustainable development operate. They approximate an international consensus on what is meant by sustainable development and are therefore central to any comprehensive approach to sustainable development. However, different individuals and organisations fill in the details of sustainable development in very different ways. This is largely due to varying emphasis placed on the different elements of sustainable development. I will consider the predominant definition of the different elements of sustainable development in the next section.

1.4.2 The three pillars of sustainable development

The *Johannesburg Declaration on Sustainable Development* (United Nations 2002b, paragraph 5) identifies three 'mutually reinforcing pillars of sustainable development – economic development, social development and environmental protection'. The assumption that sustainable development has these **three pillars** – the economic, environmental and social – is common in many international, national and local approaches to sustainable development. It is particularly popular in the corporate sector, where it underpins **triple bottom line** (TBL) accounting and reporting frameworks.

Triple bottom line reporting is an attempt to expand corporate reporting beyond the traditional financial bottom line to include environmental impact and social contribution. The *Sustainability Reporting Guidelines* released by the Global Reporting Initiative (GRI 2002) are part of an emerging global standard for TBL reporting by organisations. According to these guidelines, the TBL approach 'is currently the most widely accepted approach to defining sustainability' (GRI 2002, p.9). I would agree, while noting that a widespread rhetorical commitment to the TBL approach does not necessarily equate to a common understanding of what is meant by sustainable development.

I am not aware of any theoretical basis for the argument that sustainable development has three pillars. Rather, this understanding of sustainable development has emerged over time to accommodate concerns raised by environmentalists and social scientists about the consequences of unfettered economic development. This raises the possibility that popular understanding of sustainable development may expand to accommodate additional concerns in the future. For now, sustainable development is commonly understood, particularly in policy circles, as the art of balancing competing economic, environmental and social concerns arising from proposed developments.

Unfortunately, the three pillars or TBL framework provides little guidance on how to balance economic, environmental and social concerns when they are in conflict. I would argue that this balancing is a subjective matter; different people and different organisations will balance the three pillars differently depending on what they value the most. In practice, individuals and organisations often give greater weight to a particular dimension of sustainable development, depending at least partly on their disciplinary commitment. This gives rise to (at least) three different interpretations of sustainable development, which I will examine below. I stress that there is a great deal of diversity within each of these broad interpretive categories and that the boundaries between each are fluid. However, they serve to structure my discussion.

Sustainable economic development

An interpretation of sustainable development that gives primacy to economic growth and development can be traced back to the Brundtland Report (WCED 1987). Brundtland's definition of sustainable development, quoted in Section 1.4.1, does not explicitly emphasise economic growth. However, other sections of the report provide explicit support for 'economic growth for both developed and developing countries' (Diesendorf 1997). Neoclassical economists emphasise this support for economic growth and interpret sustainable development as sustainable *economic* development or sustainable capitalism. Sustainable capitalism is 'concerned with sustaining industrial economic growth' (Purser 1997, p.363), measured as growth in gross domestic product (GDP), in the face of environmental and social challenges.

In many economic interpretations of sustainable development, the primacy of economic growth and high-consumption lifestyles is never really questioned. As Michaelis (2003, p.S139) puts it: 'The "sustainable" in sustainable development is about reducing environmental load; the "development" is about increasing people's ability to consume'. Strong advocates of economic growth may not engage with environmental concerns at all; for them, sustainability of profits is the main concern. Those that *do* engage with environmental concerns tend to adopt a neoclassical approach that attempts to commodify the environment so that it can be included in economic models (Mebratu 1998, p.509). The basic argument is that the environment is undervalued and therefore overused; in economic language, the cost of environmental damage is treated as an externality by markets. The solution is to determine the price of environmental goods and use mechanisms like ecological taxation, subsidies and emission permit trading to internalise externalities. Once correctly priced, according to this argument, environmental goods will no longer be overused.

Whatever the theoretical merits of improved environmental valuation, the practical problem of determining an acceptable price for an environmental good remains an intractable one. There are numerous methods available for pricing environmental goods, such as contingent valuation and choice modelling, but none deal particularly well with issues of context and subjectivity (Adams 1995). Further, there are philosophical and ethical arguments against monetary valuation of some goods, like the existence value of a species or the value of a human life (see Section 3.7.2). Internalisation of externalities, alone, is unlikely to lead to sustainable development of the type contemplated in Section 1.3.2.

It is also unclear whether the goal of sustaining economic growth is an appropriate one. The merits and feasibility of sustained economic growth have been a central topic of debate within the sustainable development discourse for many years (see van den Bergh & de Mooij 1999). Advocates of sustained economic growth (e.g. Beckerman 1992; Simon 1996) argue that it provides the wealth required to protect the environment and develop new technologies with lower environmental impact. In Australia, this argument is captured in the fourth principle of the National Strategy for

ESD, which states that 'the need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised' (Commonwealth Government 1992). Similarly, many authors advocate sustained economic growth on social grounds, as a way of eradicating global poverty (e.g. UNDP 2003, p.17). This last argument is particularly persuasive.

Critics of sustained economic growth point out, for example, that the growth in energy and resource consumption that underpins economic growth cannot be sustained indefinitely on a finite planet (e.g. Daly 1990, 1996). This **limits to growth** argument stretches back to Malthus ([1798] 2003). I will examine this argument more closely in the next section, as it tends to be associated with an ecological interpretation of sustainable development. The point to make here, following Sachs (1999, p.30), is that there are good and bad kinds of economic growth. Certainly, the blind pursuit of economic growth at the expense of ecological health and social equity is problematic. However, it is also possible to pursue a type of economic growth that is environmentally benign and socially progressive.

Within the broad category of interpretations of sustainable development that emphasise economic growth, it is possible to identify advocates of destructive and constructive types of growth, and many positions in between. There are the technological optimists (e.g. Beckerman 1992; Simon 1996), who defend neoclassical economics and argue that markets and human technological ingenuity will respond to environmental problems as they arise (Mebratu 1998). In contrast, there are those who advocate new, ecologically sensitive business models in which there are no conflicts between economic growth and environmental protection (Hawken, Lovins & Lovins 1999). At this time, the sustainability of economic growth, and the form that sustainable economic growth might take, remain empirical questions.

Of course, not all who write about the economics of sustainable development are advocates of economic growth. Many researchers focus on the design of economic markets and instruments to reduce environmental impact, or use economic tools and methods to identify the most cost-effective environmental protection options. Much of the work in ecological economics and political economy falls into this category (e.g. Costanza 1989; Dodds 1997b; Hamilton 1997; O'Connor 1994). These authors take various positions in the economic growth debate, but their main focus is on the practical task of improving the environmental and social outcomes delivered by economic systems. It is this type of work that provides the clearest pathway towards integration of environmental and economic objectives.

Ecologically sustainable development

An ecological interpretation of sustainable development gives primacy to the sustainability of ecological systems, whether on utilitarian, aesthetic, moral or philosophical grounds. Ecological interpretations point out that humans rely on nature for survival, so only development that does not compromise natural systems is sustainable. An ecological interpretation of sustainable development readily coexists with evolutionary systems theory, which foregrounds human dependence on ecological systems (e.g. Kay et al 1999; Robèrt et al 2002). I will consider systems theory and sustainable development separately, in Section 1.4.3.

In Australia, an ecological interpretation of sustainable development is embedded in national strategies and in national environmental legislation through the explicit adoption of the term **ecologically sustainable development** instead of sustainable development.[7] This terminology was originally adopted during the Australian ESD policy process, discussed in Section 1.2.1. The ecological emphasis came about at the insistence of environmental organisations involved in the ESD policy process, who argued that an explicit reference to the ecological underpinnings of sustainable development was crucial (Harris & Throsby 1998). However, the rhetorical adoption of an ecological interpretation of sustainable development did not lead to the adoption of ecological principles or practices. According to Connor and Dovers (2004, p.34): 'The principles of ESD adopted by Australia…strongly reflect the economic growth element of the Bruntland [sic] construction of sustainable development'. That is, economic interpretations of sustainable development are dominant in Australia.

An ecological perspective provides the foundation for many of the critiques of sustained economic growth. From an ecological perspective, it is clear that the economy depends on healthy ecological systems for its survival. Healthy ecological systems do not grow indefinitely (Costanza 1989) and the Earth's natural resources are finite (Georgescu-Roegen 1971). If economic growth remains coupled to growth in resource consumption, as it is now, there will be an inevitable conflict between the finite capacity of ecological systems to provide resources and assimilate waste and the growing economic demand for resources. In other words, there are ecological limits to growth (Meadows et al 1972).

Advocates of an ecological perspective also point out that ecological systems and natural resources have non-economic values, such as aesthetic and existence values, that are ignored by measures of economic growth. Further, the complexity of ecological systems and uncertainties about their behaviour mean that their true value is unknown. Consequently, measures of economic growth undervalue ecological systems. Building on these insights, some authors reject the idea of sustainable economic growth as an oxymoron (Robinson 2004) and argue that the only sustainable

[7] See, for example, the National Strategy for Ecologically Sustainable Development (Commonwealth Government 1992) and Section 3A of the *Environment Protection and Biodiversity Conservation Act 1999*.

economy is a steady-state economy reliant on renewable flows of energy and materials that do not diminish ecosystems (e.g. Daly 1990, 1996).

The steady-state economy argument is directly opposed to the technological optimist argument that economic growth is indefinitely sustainable. I am more sympathetic to the steady-state economy argument, at least in the long-term, given the mounting evidence of ecological and social decline outlined in Section 1.2 and the stark failure of even the rich industrialised nations, with their unprecedented levels of wealth and technological ingenuity, to address this decline. Further, given that the capacity of ecological systems to sustain damage without failing is uncertain, the strategy of pursuing wealth before reducing environmental impacts is a risky one. Ecological systems may collapse without warning, in which case any amount of wealth will be useless.

The technological optimist argument is also problematic for its arrogant assumption that humans can manage or replace complex ecological systems. This assumption is not borne out by historical experience. As Purser (1997, p.365) points out:

> The prospects that nature and the planet's ecosystems may very well become dependent on human management should make even technological optimists pause. Human societies have a poor track record for managing their own socioeconomic affairs, even on a local scale let alone on large-scale, complex, and interconnected ecosystems whose functioning are barely understood.

Although more convincing than the technological optimist argument, the steady-state economy argument is not without limitations. Most important of these is its inadequate attention to social equity. As many critics have pointed out, the global economy is not yet able to provide a reasonable standard of living for billions of people. It is difficult to see how poverty eradication can proceed without some sort of growth in material living standards (Sachs 1999, p.30). The task, then, is to find a balance between the social objective of poverty eradication and the need to respect the constraints imposed by ecological limits. Ecological interpretations of sustainable development, alone, are insufficient. I therefore turn, in the next section, to social interpretations of sustainable development.

Social perspectives on sustainable development

Social perspectives on sustainable development are as diverse as the fields of inquiry that make up the social sciences and it is not possible to do this diversity justice in a brief discussion. However, the edited collection of papers in Becker and Jahn (1999) provides an excellent overview of this diversity across several disciplines. Some of the issues emphasised by those that take a social perspective on sustainable development include individual and community well-being (Dodds 1997b), intergenerational equity (Birkeland, Dodds & Hamilton 1997), social equity and justice (Yencken & Porter 2001), poverty (UNDP 2003), human rights (Sachs 2003), public participation in decision-making (Kasemir et al 2003b), governance (Bulkeley & Mol 2003), institutions (Connor & Dovers 2004) and the culture of consumption (Hamilton 2003).

Whereas ecological approaches tend to define environmental problems 'in terms of physical flows of matter and energy', the social sciences tend 'to define them in terms of human behaviour' (Cohen et al 1998, p.341). Social perspectives on sustainable development emphasise the individual and cultural factors that drive humans to create environmental problems. They draw attention to the human impacts of economic and environmental issues and focus on ways of bringing about personal and organisational change through policy and individual action.

As noted previously, social perspectives on sustainable development are not necessarily opposed to economic growth. Many people in poorer countries lack even the basic means of survival; economic growth has the potential to reduce poverty and enhance well-being in those countries. However, social perspectives may emphasise the diminishing returns that result from economic growth in advanced industrial societies (e.g. Hamilton 2003; Inglehart 2000) or draw attention to the history, epistemological assumptions and values underpinning the modern commitment to economic growth (e.g. Dryzek 1997).

The subject matter of the social sciences is so broad that there is a tendency, in practice, for the social dimension of sustainable development to become a vehicle for any desirable social changes that are not economic or environmental. Further, as I have argued previously, what is desirable depends on the values held by an individual. As a result, it is impossible to reach a shared understanding of what is meant by the social aspect of sustainable development. For some people, a socially sustainable society is one in which basic human needs are met within ecological constraints (e.g. Robèrt et al 2002). Others advocate a society characterised first by social justice, full employment and full democracy, and only subsequently by reduced environmental impact (e.g. Sachs 1999, p.33). More radical ideologies, such as eco-theology, eco-feminism and eco-socialism, envisage alternative societies that are the product of transformative social change (Mebratu 1998). The diversity of social perspectives serves to highlight the plurality of values.

Social perspectives on sustainable development are far more likely than economic or ecological perspectives to draw values into the foreground, making them explicit. Indeed, the social sciences offer specific methods for drawing out and analysing values and their role in sustainable development. Some examples are Werner's (1999) review of psychological perspectives on sustainability, Braidotti's (1999) exploration of sustainable subjectivity, Dryzek's (1997) work on environmental discourse, Hamilton's (2002) discussion of the intuitive aspect of sustainability and Michaelis' (2003) examination of the cultural aspects of consumption. In addition, the work on culture and civil society identified by Pezzoli (1997a; 1997b) grapples with issues of epistemology, values and ethics in relation to sustainable development (e.g. Engel & Engel 1990; Zimmerman 1994). Clearly, the social sciences offer a rich literature on subjectivity and sustainable development as a starting point for my research.

However, this type of research has not penetrated mainstream understanding of sustainable development. Considering the specific case of psychological perspectives on sustainable development, Maiteny (2000, p.340) argues that:

> The psychological dimensions of sustainable development, and their implications for behaviour, have been largely neglected by policy-makers and social science researchers of the environment…[A] sustainable future depends on sustainable changes in human behaviour – ie by persons – and that sustainable behaviour change depends, in turn, on meaning and conviction, as much as it depends on structural changes in society.

More broadly, Becker, Jahn and Stiess (1999, p.2) argue that sustainability remains 'unfamiliar ground for the social sciences'. In part, this is due to ongoing reluctance on the part of social scientists to engage with a discourse that is 'innately reformist, mostly avoiding questions of power, exploitation, even redistribution' (Becker, Jahn & Stiess 1999; Robinson 2004, p.376). Consequently, particularly in the widespread TBL approaches, the social dimension of sustainability is often given token attention, reduced to economic well-being, or addressed without sensitivity to plural values. Ongoing social research on sustainable development, values and political empowerment is an evident priority.

Are three pillars enough?

It is far from clear whether sustainable development can be adequately understood and implemented by focusing solely on the economic, ecological and social aspects of development. As noted previously, there is no underlying theory to justify a focus on these three aspects alone. It is not surprising, then, that numerous authors propose a fourth pillar of sustainable development. However, there are very different opinions on what the fourth pillar should be. A quick Internet search finds advocates for institutions, culture, future generations, well-being, governance (sometimes general, sometimes specifically corporate), spirituality, universal harmony, influence and transparency as the fourth pillar of sustainable development. Many of these issues are currently subsumed under the social dimension of sustainable development.

This diversity serves, firstly, to underline the importance of values in determining what is meant by sustainable development. Different authors tend to promote those issues that are of most interest to them as being crucial to sustainable development. Second, it points to the need for a coherent theory identifying the crucial elements for inclusion in a comprehensive approach to sustainable development. Evolutionary systems theory, which I consider in the next section, provides one possible theoretical solution.

1.4.3 Evolutionary systems theory and sustainable development

Evolutionary systems theory provides a foundation for many popular conceptual approaches to sustainable development, including the strategic sustainable development framework outlined by Robèrt et al (2002), the 'ecosystem approach' discussed by Kay et al (1999), the indicator-based approach outlined by Bossel (1998) and much of the work in ecological economics (e.g. Daly 1990; Daly 1996). The foundation of evolutionary systems theory is an ontological assumption that reality is composed of nested and interacting systems that evolve over time. This leads to an epistemological commitment to a suite of methods for analysing systems as wholes, rather than breaking them into their constituent parts. These methods make up the system sciences – the 'sciences of organized complexity' (Laszlo 1996b, p.8).

Complex systems have particular attributes that system theorists analyse. For example, they have inputs, outputs, subsystems and feedback mechanisms. As complex systems evolve, new system properties emerge in unpredictable ways. Further, complex systems are self-organising, in the sense that they maintain a recognisable pattern or structure despite changing environmental conditions.

When evolutionary systems theory is applied to sustainable development, it usually leads to a particular understanding of the relationship between economic, ecological and social systems that is consistent with the ecological interpretation of sustainable development discussed in Section 1.4.2. The argument, in outline, is that human social and economic systems are dependent on the existence and healthy functioning of ecological systems as sources of inputs of energy and materials, and as sinks for assimilating outputs of waste and pollution. Consequently, maintaining the integrity of ecological systems is the first priority for sustainable development. Further, systems theory defines the economic system as an element of the social system, in the sense that humans establish the rules for economic exchange and distribution of resources. Therefore, the viability of the social system is a higher priority than that of the economic system.

This argument gives rise to the decision-making framework represented schematically in Figure 1.1. The figure is adapted from a typical framework presented in Australia's 1996 State of the Environment Report (SEAC 1996). According to Australia's State of the Environment Advisory Council (SEAC 1996, pp.10-12), this decision-making model:

> …recognises that the economy is a sub-set of society, since many important aspects of society do not involve economic activity. Similarly, human society is totally constrained by the natural ecology of our planet. It requires integration of ecological thinking into social and economic planning.

The use of systems theory to clarify the relationships between economic, ecological and social systems is the most common mainstream application of systems theory to sustainable development. This is a relatively unsophisticated application of systems theory, drawing primarily on the insight that systems exist in nested relationships with other systems. A more sophisticated application of evolutionary systems theory, drawing on non-equilibrium thermodynamics, is evident in the ecosystem approach to sustainability outlined by Kay et al (1999). Kay et al (1999, p.721) use a conception of ecosystems and human systems as self-organising nested systems to critique conventional scientific explanations and models that rely on 'linear causality and stochastic properties'. They argue that, as a consequence of system complexity, the role of scientists should be to outline scenarios or narratives about the different ways that the future might develop or evolve, instead of trying to provide certainty. They outline a detailed approach to ecosystem sustainability that draws on complex systems theory, visioning and consideration of cultural values, within an adaptive management framework (Kay et al 1999, p.739). I will return to this approach in Chapter 8, while noting here that the sophisticated systems thinking advocated by Kay et al is rare in mainstream sustainable development policy and practice.

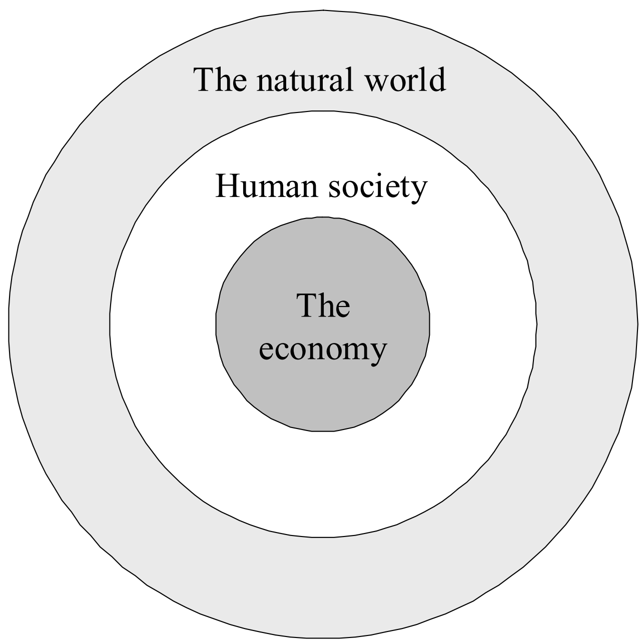

Figure 1.1: A decision-making framework for an ecologically sustainable future.
Adapted from SEAC (1996, pp.10-12).

One systems approach that has achieved widespread application, particularly in the corporate sector, is the strategic sustainable development framework outlined by Robèrt et al (2002). The framework is based on three conditions for ecological sustainability (Robèrt et al 2002, pp. 198-199):

> In the sustainable society, nature is not subject to systematically increasing…
>
> 1. Concentrations of substances extracted from the Earth's crust.
> 2. Concentrations of substances produced by society.
> 3. Degradation by physical means.

Robèrt et al (2002, pp.198-199) add a fourth system condition requiring that, in a sustainable society, 'human needs are met worldwide'.

These four conditions draw on a consensus document originally developed by Karl-Henrik Robèrt with the assistance of 50 Swedish scientists. The system conditions draw on the laws of thermodynamics and an understanding of natural cycles. Robèrt et al. (2002) elaborate these conditions as part of a five-level framework for strategic sustainable development.

The first level defines the system of interest as the ecosphere, which comprises human 'societies and their surrounding ecosystems' (Robèrt et al 2002, p.198). The second level establishes the four system conditions as principles of sustainability and describes two basic mechanisms by which these conditions can be met:

- Dematerialisation – the reduction of material flows
- Substitution – the exchange of type/quality of flows and/or activities.

The third level of the framework establishes process principles for achieving sustainable development. These include four principles to guide strategic investment decisions (pp.201-202):

- Backcasting – defining the desirable future towards which investment is oriented
- Flexible platforms – preferring flexible investments as a way of avoiding future "dead-ends"
- Good return on investment – the adoption of sound commercial principles to guide investment
- The precautionary principle – which I have already discussed, in Section 1.3.2.

There are also two social principles (p.202):

- Dialogue and encouragement – as a way of facilitating community building and teamwork
- Transparency – as a way of building trust and identifying successes and failures.

Finally, there are seven principles outlining the political means by which sustainable development can proceed (pp.202-204):

- Differentiated taxes – e.g. taxes on undesirable flows of energy and materials
- Subsidies – as a temporary measure to encourage development of ecologically sensitive technologies
- Traditional privileges – charging appropriately for property rights over natural resources
- Norms and standards – reviewing standards and norms to ensure they contribute to sustainability
- International agreements – as a way of achieving global cooperation on global environmental and social issues

- International trade and economic development – review of trade agreements in light of the objective of ecological sustainability
- Legislation – law enforcement to protect the global commons.

The fourth level of the framework uses these thirteen process principles to guide diverse concrete actions, such as substitution of renewable energy sources for fossil fuels. The fifth level of the framework focuses on monitoring the impact of these actions, evaluating compliance of the actions with the overall objectives, and monitoring the ecosphere itself to determine its state.

An important achievement of the framework proposed by Robèrt et al (2002) is the integration of many well-known tools and methods associated with sustainable development into a coherent theoretical construction. The framework finds room for Factor X approaches, life cycle assessment (LCA), material input per unit service (MIPS), ecological footprinting, natural capitalism, and environmental management systems, to name a few of the more prominent methods. Evolutionary system theory, because it draws attention to the relationships between systems, is ideally suited to integrative tasks like this one.

However, Robèrt et al's (2002) framework, and evolutionary systems theory more generally, are subject to some important limitations. First, although there is widespread agreement that the system conditions capture the physical conditions for ecological sustainability, they remain too vague to guide practice. In practice, there are many different opinions on the renewable yield and assimilative capacity of natural systems, the necessary internal changes to social systems and desirable levels of human consumption. Here, values are again crucial. Different theorists will prioritise different strategies for achieving sustainability, depending on their personal values. Systems approaches provide little guidance on how these different values can be balanced.

The second limitation is similar to that already outlined for ecological interpretations of sustainable development; it remains unclear how social equity is balanced with ecological objectives. In the framework outlined by Robèrt et al, this is a question of how to balance the first three system conditions with the fourth. The position taken by Robèrt et al (2002) is that there are actions which will improve compliance with all four system conditions, and that these should be preferred. In practice, conflict between the system conditions, and between environmental and social objectives, is inevitable and is not adequately addressed.

Finally, despite the admirable attempt to include social objectives via the fourth system condition, an objective to meet human needs worldwide does not provide the guidance needed to address numerous difficult social issues. The context in which the fourth system condition is presented strongly suggests that the authors conceive of human needs as homogeneous and objectively determinable. However, numerous authors (e.g. Douglas et al 1998) have shown that human needs are not fixed and are not amenable to objective analysis. Human needs are socially constructed and vary subjectively with context and values. Further, it is unclear how Robèrt et al distinguish between needs and wants. The distinction between a need and a want is an ethical one that different subjects, with different values, will make differently.

The treatment of needs by Robèrt et al is symptomatic of a broader tendency in systems theory to treat people as little more than homogeneous strands in the complex web that makes up a social system, denying any variation in values altogether. As a result, systems approaches tend to concentrate on the technological, economic and institutional changes required for sustainable development, ignoring any associated personal or cultural changes.

1.4.4 Transdisciplinarity

One final issue I wish to discuss with respect to sustainable development is that of transdisciplinarity. From the literature I have reviewed so far, it is clear that sustainability and sustainable development are concepts that range across disciplines, resonating with economists, ecologists, social scientists and system theorists, to give just a few examples. Solutions to global environmental and social problems require, at the very least, a cross disciplinary approach (Norgaard 1995). Lawrence and Després (2004) discuss different types of cross disciplinary research: multidisciplinary, interdisciplinary and transdisciplinary. My discussion of these types of research below draws on Lawrence and Després and their summary of other contributions to a special issue of *Futures* on transdisciplinarity.

Multidisciplinary research brings together the work of multiple disciplines operating in a relatively self-contained and independent manner. The integration across disciplines is limited to summation of findings. Interdisciplinary research goes a little further, seeking to integrate disciplinary perspectives on a particular problem to provide a systemic outcome. However, disciplinary boundaries are not transgressed. Transdisciplinary research, on the other hand, seeks to break down traditional disciplinary boundaries and organise 'knowledge around complex heterogeneous domains' (Lawrence & Després 2004, p.400). The prefix *trans* signifies both the transgression of boundaries and the transcendence of the disciplinary components. That is, in moving beyond disciplines, transdisciplinary research attempts to generate synergies and new types of knowledge.

Lawrence and Després identify four aims of transdisciplinary research. First, transdisciplinary research attempts to address complex problems by integrating fragmented knowledge. Second, it responds to uncertainty by negotiating context-specific knowledge. Third, it aims to generate intersubjective knowledge through processes of close collaboration and practical reasoning, within contextual constraints. Fourth, transdisciplinary research is action-oriented, seeking linkages between theory and practice, relevant to actual problems. Given these characteristics, a transdisciplinary research approach would seem to have much to offer an inquiry into sustainable futures.

1.4.5 Discussion

I have drawn two broad conclusions from this brief survey of sustainable development literature that will guide the refinement of my research questions. First, mainstream conceptual frameworks for sustainable development, including *Agenda 21*, TBL approaches and evolutionary systems theory, fail to adequately consider the issue of subjectivity that I first raised in Section 1.3.1. Issues of subjectivity in relation to sustainable development *have* been considered by social scientists (e.g. Becker & Jahn 1999; Dryzek 1997). However, this work has not significantly influenced *mainstream* conceptions of sustainable development, government policy and organisational practice. In much discussion of sustainable development, there is an implicit assumption that human values are homogeneous. When plural values *are* recognised, usually in the context of advocating a change in values, there is no theoretical model of how values change over time. An underlying theory of subjectivity, or the social and personal construction of reality, is lacking. This conclusion resonates with Mebratu's (1998, p.517) call for 'a concrete body of theory on sustainable development'.

Second, it is clear that sustainable development has multiple dimensions that are difficult to balance in practice. In the three pillars or TBL approaches, it is the balance between economic, environmental and social objectives that is problematic, as evidenced by the ongoing economic growth debate. In the strategic sustainable development framework outlined by Robèrt et al (2002), it is the balance between the four system conditions, and/or the ecological and social, that is problematic. It is not that the objectives, conditions or principles lack merit; it is simply that there is insufficient theoretical guidance on how each should be prioritised in specific contexts. In addition, it is not clear that the three dimensions of sustainable development that receive the most attention – the economic, environmental and social – are actually sufficient to capture all the important elements of sustainable development. Again, there is no theoretical basis for choosing which dimensions to consider.

Given the first conclusion, an appropriate focus for my research questions would be on the development of a theoretical and practical approach for allowing adequate consideration of subjectivity and value construction in sustainable development. This implies significant engagement with the social sciences and different social constructions of sustainability. Given the second conclusion, my research questions could focus on ways to integrate the different dimensions of sustainable development, perhaps through transdisciplinary research. Robinson (2004, pp.378-379) argues for the importance of both of these types of research in his review of current conceptual issues in sustainable development. To guide further refinement of my research questions, I will now turn to the futures literature.

1.5 Ways of knowing the future

Slaughter (2004, p.xxii) identifies two basic motivations for studying the future. The first is to avoid danger. The second 'is to set goals, dream dreams, create visions, make designs; in short, to project upon the future a wide range of purposes and intentions'. Both these purposes have ancient origins, and both are relevant for an inquiry into sustainable futures. A sustainable and desirable human civilisation must find ways to avoid or manage dangers, while holding true to a shared vision of society.

Although humans have always studied the future, it is only in the 20th century that this study began to take shape as an academic discipline, most commonly labelled **futures studies** (FS). Futures studies is an integrating discipline, or 'metadiscipline', that draws on many different methods and ways of knowing to explore the breadth of possible futures (Slaughter 2002c). Like the sustainable development literature, the futures literature is concerned both with avoiding undesirable futures and with identifying actions required today to create desirable futures.

The breadth of futures work is reflected in the many typologies of the future, and ways of knowing about the future, evident in the literature (e.g. Amara 1981; Inayatullah 1990; Mannermaa 1991; Slaughter 2004; Tapio & Hietanen 2002). Amara's (1981) division of futures into the probable, the possible and the preferable is useful for an inquiry into sustainable futures. It serves as a reminder that desirable futures may be quite different to the most likely futures and that action is required to bring about preferable futures. Inayatullah's (1990) work on the epistemology of FS is also valuable. Inayatullah identifies predictive-empirical, cultural-interpretive, and critical-poststructural positions that underlie futures work. I will discuss these epistemological positions in more detail below.

Slaughter (2004) discusses four phases or historical traditions in futures work: empirical, cultural-critical, international-multicultural and integral. Each of these traditions uses a different approach to generate knowledge about the future. Importantly, each of these traditions has a different approach to subjectivity and the social construction of reality. I use Slaughter's categories to structure further discussion of ways of knowing the future below. My objective is to further refine my research questions by identifying an appropriate epistemological approach to the future.

1.5.1 Empirical futures work

Slaughter (2004, p.152) identifies a formative empirical tradition of futures work that was (and is) particularly strong in North America:

> [The] American empirical tradition developed in post-Second World War military contexts and, by the 1980s, became generalized into corporate and other contexts…While its focus was almost exclusively on changes in the external world it nevertheless developed some useful strategies for exploring the dynamics, trajectories and possible futures of that world. The most well known of these strategies included trend analysis, technology assessment, forecasting and scenarios.

Inayatullah (1990) identifies a similar tradition, which he labels 'predictive-empirical'. Predictive-empirical futures work seeks to progressively discover, explain, forecast and control the future using models of ever-increasing complexity. Empirical approaches assume that 'the universe is by and large stable, with discernible laws' and that meaning is independent of human values (Inayatullah 1993, p.237). Implicitly, empirical approaches assume that there is a single, predictable future that can be discovered, given sufficient information. Empirical approaches attempt to discover this future using 'a futures studies based on the empirical natural science model' (Inayatullah 1990, p.117).

Empirical futures work adheres to an objectivist epistemology. Objectivists contend that knowledge exists independently of the observer and that the appropriate perspective for discovering this knowledge is the positivist perspective on which traditional empirical science is founded (Crotty 1998). The positivist researcher seeks to discover universal truths or laws through careful, disinterested research and observation. Subjectivity is treated as a potential source of bias that must be carefully managed by cultivating detachment and by submitting all work for peer review. Almost all typologies of futures work identify an objectivist and positivist category, variously labelled as technocratic, extrapolative or descriptive (Tapio & Hietanen 2002).

Slaughter (2004, p.152) argues that the empirical tradition was in decline by the mid-1980s. However, predictive or empirical approaches are still widespread and the tools developed by the empirical tradition are used by numerous organisations. While the cutting edge of futures work has moved decisively beyond the empirical tradition, applied futures work lags behind. As recently as 1992, the outgoing president of the World Futures Studies Federation described futures studies as the 'last bastard child of positivism growing up in a postmodern age' (Jim Dator in an email cited by Inayatullah 1993), indicating the continuing influence of empirical approaches.

The popularity of the empirical stance in FS is perhaps linked to the desire of FS to be taken seriously as a discipline. In the 1950s and 1960s, when many of the methods and tools of the empirical tradition emerged, futurists were very concerned with being *scientific* in their approach, so that FS would be accepted as a science in its own right. Predictive futures work, at first, proved quite successful. Mannermaa (1991) argues that predictive futures work was relatively successful during the 1950s and 1960s because economic growth was rapid and stable, and social goal setting at the time was relatively cooperative.

Challenges to empirical futures work began to appear during the turbulent 1970s and 1980s, when inaccurate forecasts and unfulfilled predictions led to growing scepticism about futures work and reduced research funding (Mannermaa 1991; Moll 2001). In addition, wider critiques of the traditional scientific model from (for example) social scientists, environmentalists and system theorists proved particularly relevant to empirical futures work, drawing attention to the inadequate treatment of uncertainty and values in empirical futures work. I will examine these twin critiques below.

Treatment of uncertainty

According to Robinson (2003, p.841), uncertainty about the future stems from three sources:

- Lack of knowledge about system conditions and underlying dynamics
- The prospects for innovation and surprise
- The intentional nature of human decision-making.

Positivists argue that the first two sources of uncertainty can be overcome by progressively improving models and including more variables (Mannermaa 1991). Indeed, it is the essence of the positivist project to progressively reduce these sources of uncertainty. However, system theorists question the validity of the positivist project, arguing that it is theoretically impossible to pre-state all possible future outcomes for most real systems (e.g. Kauffman 2000; Kay et al 1999). The behaviour of complex systems, including ecosystems and human systems, is non-linear, chaotic and sensitively dependent on initial conditions and contexts that are not fully known (Kay et al 1999). Further, complex systems exhibit unpredictable emergent phenomena as they evolve. Consequently:

> In principle, it will not be possible in many situations to construct accurate quantitative models which forecast the future to the degree required for anticipatory management' (Kay et al 1999, p. 726)…When all is said and done, our ability to predict is severely limited. Unexpected events and trends will occur. Surprise will happen, complexity will emerge (p.731).

The third source of uncertainty is equally important. Robinson (2003) is critical of predictive approaches for their incongruence with the way humans approach the future in everyday life. Humans usually set goals and act to achieve them, rather than attempting to predict an uncertain future. Human behaviour is normative, or goal-oriented, rather than predictive (Robinson 2003).

I am not arguing here that empirical futures methods are without value. Rather, the nature of future uncertainty establishes boundaries on what should be expected from empirical tools. Predictive approaches are useful in many instrumental applications on micro- and medium-scales, particularly when dealing with linear systems such as physical infrastructure (Slaughter 2004, pp.101-102). They should not be used to predict the behaviour of large-scale complex systems, particularly social systems.

Treatment of values

The second major criticism of empirical or predictive approaches is that they fail to account for the role of subjective values in creating knowledge – they ignore the social and personal construction of reality. There are many ways in which subjectivity can intrude into empirical futures work, from the choice of method, to the choice of system to study, to the choice of assumptions to use in predictive models. These choices are all value-driven and context dependent. Inayatullah (1990) argues that, because empirical futures work is unconscious of values and context, it merely 'reinscribes' present power relations, worldviews and values in the future. In other words, empirical approaches colonise the future with the values of the forecaster (Inayatullah 1990).

In various writings, both Inayatullah and Slaughter seek to expose the values and worldview commitments that underlie empirical futures work. For example, Slaughter (2002e, p.229) argues that much of the empirical FS literature from the 1960s and 1970s reads as 'an expression of the modernist project to subdue cultural difference, conquer nature, remove limits, promote economic growth and support the expansion of science and technology into ever wider domains'. There are close parallels here with the technological optimist position discussed in Section 1.4.2 and its denial of limits to material and economic growth.

Clearly, empirical futures work does not offer the engagement with subjectivity that I am seeking in my research. As Slaughter (2002b, p.27) puts it, forecasting approaches cannot 'tell us much of value about how we should operate in the world and, more particularly, how we should solve some of the very serious problems facing humankind'. These sustainability problems require a much more thorough consideration of the role of values in shaping the future. Fortunately, other traditions of futures work have engaged more strongly with the issue of subjectivity, starting with the cultural tradition identified by Slaughter (2004).

1.5.2 Cultural and critical futures work

The cultural tradition

The second futures tradition identified by Slaughter (2004, p.152) is 'a more culturally based approach (or rather a series of them) mainly originating in Europe and eventually leading to the critical tradition'. Compared to the American empirical tradition, the cultural or European tradition of futures work was more interested in the social, cultural and political aspects of the future and gave far greater consideration to 'questions of value and meaning' (p.153). Where the empirical tradition emphasised objectivity, the cultural tradition emphasised subjectivity and compared different cultural interpretations of the future.

A cultural tradition is recognised in numerous typologies of futures work, although the labels vary and different authors emphasise different aspects. In the typologies reviewed by Tapio and Hietanen (2002), the hermeneutic, practical, visionary and emancipatory types of futures work all share many characteristics with Slaughter's cultural tradition. The cultural-interpretive approach to futures work, identified by Inayatullah (1990), covers similar conceptual territory. Cultural-interpretive approaches are sensitive to the role of cultural context in shaping the type of future that people desire, and the type of future that becomes real. These approaches recognise that reality is, to some extent, socially and culturally constructed. They do not necessarily deny that there is a reality independent of the observer, but they argue that the values of the observer and the context in which they are embedded crucially shape how that reality is known.

Given that values and contexts vary, 'there is no one way to constitute the real, the future' (Inayatullah 1990, p.123). Cultural approaches recognise the existence of a multiplicity of alternative future images and examine 'how different cultures, cosmologies, discourses approach and create the future' (Inayatullah 1993, p.237). How, for example, do Eastern images of the future differ from Western images of the future? How do the futures valued by environmentalists differ from those valued by economists? Methodologically, futurists who adopt a cultural approach must rely on interpretive methods to understand the future images of cultures to which they do not belong. Using these methods, cultural-interpretive futures work can help to recover 'alternative futures that have been silenced by various oppressive structures' (Inayatullah 1990, p.128). That is, cultural approaches give voice to a much wider range of futures than predictive approaches.

In recognising the existence of alternative futures, cultural-interpretive approaches reject the idea of a single objective future waiting to be discovered. In this, they are consistent with the broader postmodern rejection of universal laws in favour of culturally and historically specific laws (Inayatullah 1993). However, a limitation of cultural-interpretive approaches is that they make no attempt to criticise the cultural basis of the alternative futures they reveal. As Inayatullah (1990, p.127) puts it, 'any future is as good as any other future' and 'we are suddenly anchorless in a sea of cultures'. Interpretive approaches give no guidance on which futures are preferable. They also leave power relations largely unexamined (Crotty 1998; Inayatullah 1990). This is the departure point for critical futures work.

Critical futures work

Critical futures work is not so much a separate futures tradition as a deepening and fulfilment of the cultural tradition, growing out of an ongoing engagement with postmodernism, poststructuralism and critical social theory. In his doctoral thesis, Slaughter (1982) originally proposed critical futures studies (CFS) as a way of engaging with the inner world of subjectivity as well as the outer world of objectivity. The initial conception of CFS drew mainly upon critical social theory (e.g. Habermas 1971), hermeneutics and the sociology of knowledge (Slaughter 1989). Consistent with the cultural tradition, it drew attention to the social construction of reality. However, CFS attempts to go deeper by investigating the genealogy of present ideas and assumptions and revealing the layers of 'language, culture, ideology, worldview' that underlie perceptions of what is real and possible (Slaughter 2004, p.105).

The important contribution of critical futures work is to draw attention to, and problematise, unexamined worldview commitments, power relations, discourses, values and epistemological assumptions that lead to undesirable futures. It uses postmodern critique and deconstruction to reveal these unexamined assumptions. However, CFS is also committed to reconstruction. Its purpose in revealing unexamined assumptions is to open up a wider range of possibilities for the future, thereby offering a source of hope and renewal (Slaughter 2004, p.92).

Like Slaughter, Inayatullah (1990) identifies a critical approach to futures work. However, Inayatullah's approach has its origins in poststructuralism, rather than critical social theory. Poststructural thought focuses attention on power relations, deep worldview commitments (and their origins), the multiple discourses that shape personal identity, and the crucial role of language in determining and transmitting meaning. Drawing on poststructural thought, Inayatullah (1990) argues that the three approaches to futures work he identifies – the predictive-empirical, the cultural-interpretive and the critical-poststructural – should be understood as different discourses with their own values and assumptions. Each has something to contribute to a comprehensive exploration of futures.

Inayatullah (1990, p.131) advocates a 'both-and' approach to futures work: 'With a post-structural perspective, a both-and approach (the predictive, cultural and critical) becomes possible as it provides a meta-theory from which the future can be created'. This both-and approach aims to 'contextualize data (the predictive) with the meanings (interpretive) we give them, and then locate these in various historical structures of power/knowledge-class, gender, *varna*[8] and episteme (the critical)' (Inayatullah 1998, p.816). Inayatullah is essentially calling for a type of epistemological pluralism, in which different ways of knowing the future are employed in parallel, with explicit attention to the constraints on the type of knowledge they generate. Other futurists have taken up this call for epistemological pluralism (e.g. Healy 2003).

Despite their different starting points, there are many similarities between the critical approaches advocated by Slaughter and Inayatullah. The two authors are united in their call for layered futures work that moves beyond surface understanding of reality to reveal deeper layers of meaning (Inayatullah 1998; Slaughter 2002a). Inayatullah (1998) has developed a specific method called causal layered analysis for drawing out worldviews, discourses, myths and metaphors, usually employed in a workshop setting. Slaughter (2002a) has proposed a method called structural mapping with similar objectives. Both authors advocate pluralism, deconstruction and a focus on epistemology. Their work is highly relevant for my own inquiry into sustainable futures as it provides a methodology for engaging with the impact of subjectivity on the present and future.

1.5.3 Multicultural futures work

The third phase of futures work identified by Slaughter (2004, p.152) is a diverse and diffuse body of work that takes an international and multicultural perspective. The first two traditions of futures work, described in Sections 1.5.1 and 1.5.2, were predominantly Western-oriented, and often ignored the values and perspectives of non-Western cultures. Particularly in the last decade,

[8] *Varna* translates as 'caste' (Inayatullah 1998).

perspectives on the future from outside the Western traditions have entered the academic futures literature, greatly enriching the quality of the work (Slaughter 2004, p.35).

The idea of an emerging multicultural tradition of futures work is itself a Western conceptualisation. Non-Western cultures have always thought about the future; it is just that non-Western viewpoints have not, until recently, been part of the Western academic discourse of FS. However, the growth of global communication networks has facilitated cross-cultural dialogue, allowing the very different conceptions of the future that exist outside the West to enrich Western academic discourse. As one example, multicultural futures work introduces different conceptions of time, such as a cyclical perception of time that contrasts with the Western notion of linear time, or 'time's arrow' (Inayatullah 1993).

Non-Western futures work is often critical of Western civilisation. Coming from *outside*, this criticism helps to reveal the deeply held worldview commitments that characterise Western civilisation. Consequently, some of this international work is closely aligned with critical futures work. Indeed, as well as being an advocate of critical futures work, Inayatullah has done much to bring other cultural voices into the academic futures discourse (e.g. Inayatullah 1988, 1993).

The notion of **dissenting futures** that refuse to accept Western cultural dominance is part of the multicultural futures tradition. Zia Sardar (1999) introduced and edited a special issue of *Futures* dedicated to dissenting futures. The work of Sardar, Ashis Nandy (see Sardar 1997) and numerous other scholars has helped to foreground multicultural perspectives in FS. The perspectives of indigenous people are also an important part of the multicultural futures tradition. Some of these perspectives were expressed in another special issue of *Futures* edited and introduced by Razak (2003).

1.5.4 Integral futures work

The final type of futures work identified by Slaughter (2004), and the one he advocates as the way forward for FS, is an emerging **integral futures work**. Integral futures work draws on the pioneering philosophical and theoretical work of Ken Wilber (e.g. Wilber 2000a, 2000b, 2000c, 2001). Wilber, over the course of dozens of books, has worked to develop a map of reality that integrates the different ways of knowing that humans have discovered or developed over the course of human history. He seeks to include objective and subjective knowledge, individual and collective knowledge, scientific and spiritual knowledge and Eastern and Western knowledge within a coherent framework that finds room for all. The most complete description of Wilber's integral map of reality is found in *Sex, Ecology, Spirituality* (Wilber 2000c). Summary versions include *A Brief History of Everything* (Wilber 2000a) and *A Theory of Everything* (Wilber 2001).

Within FS, Slaughter has been the pre-eminent translator and advocate of integral theory as a basis for futures work (Slaughter 1998a, 1998b, 2002a, 2002d, 2004). According to Slaughter (2004, p.152): 'A key aspect of the integral approach is to honour all truths and acknowledge the value of many different ways of knowing across all significant fields'. In practice, this becomes a task of balancing different epistemological and methodological approaches to the future, including the three futures traditions already discussed. Integral futures work recognises that each of these traditions has access to particular truths, and that an approach that integrates all those truths offers deeper insights into the nature of reality than any of those truths taken singly.

In attempting to integrate multiple traditions, integral futures work is similar to Inayatullah's critical-poststructural, or both-and approach. The crucial difference is that integral theory provides a conceptual framework for ensuring that all relevant perspectives are represented, as well as guidelines for resolving conflicting perspectives. Integral theory recognises four different categories of methods for understanding or constructing reality: objective (or behavioural), interobjective (or systemic), subjective (or psychological) and intersubjective (or cultural) methods. Each of these methods is associated with a quadrant on a two-dimensional diagram, an example of which is provided in Figure 1.2. According to integral theory, different ways of knowing can be distinguished from each other on the basis of whether they are objective or subjective, and individual or collective, giving the four quadrants shown in Figure 1.2. Integral theorists argue that all four ways of knowing must be included in any comprehensive methodological approach.

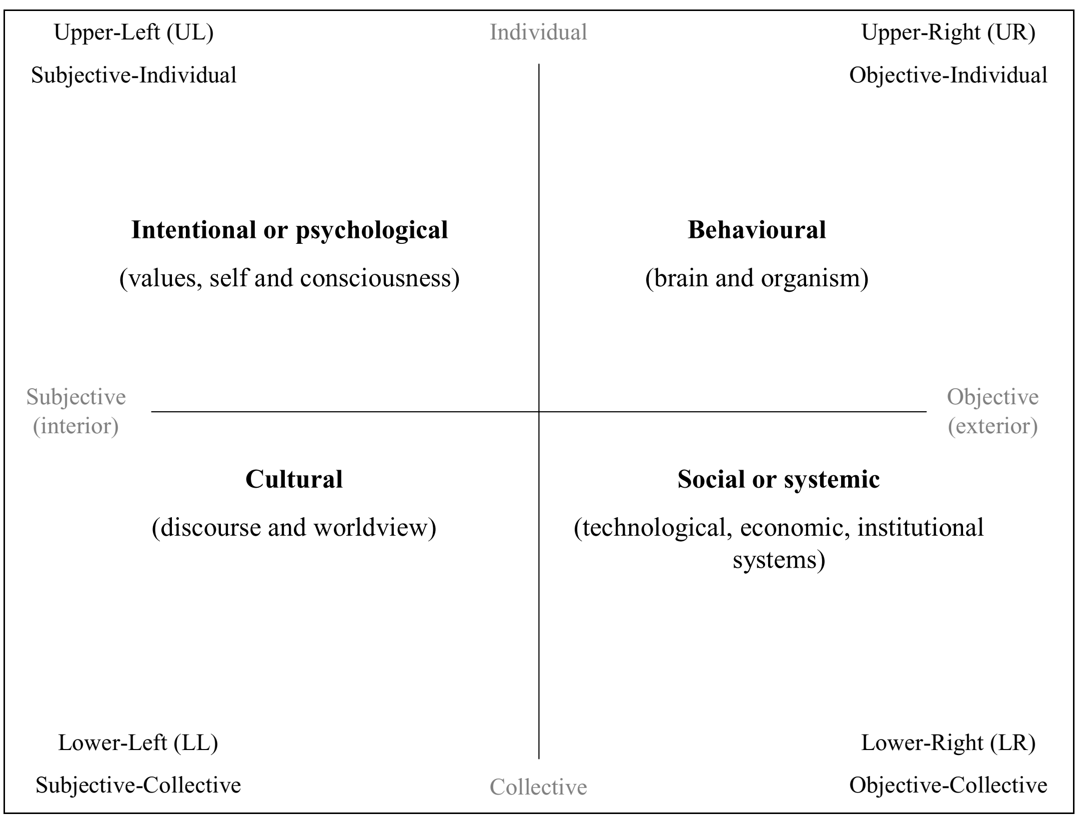

Figure 1.2: The four quadrants in integral theory.

In additional, integral theory situates these four quadrants within an evolutionary or developmental framework. Integral theorists argue that behaviours, systems, psychological structures and cultures develop through recognisable stages or levels. All these levels must also be included in any comprehensive approach. Thus, integral theorists argue for an **all-quadrants, all-levels** (AQAL) approach. I will provide a longer summary of integral theory in Chapter 2, where I will explore the basis for these concepts in considerable detail.

1.5.5 Discussion

My review of the four traditions of futures work, as outlined by Slaughter (2004), indicates that there are multiple ways of exploring the future and that each has validity for particular applications. Importantly, where the sustainable development literature gives too little attention to subjectivity, FS has devoted considerable attention to epistemological concerns, subjectivity and the role of values in shaping the future (Inayatullah 2002a). This engagement with subjective values is particularly evident in critical futures work and the emerging integral futures work. Consequently, the futures literature offers a strong foundation for introducing subjectivity into research on sustainable futures.

Of the four futures traditions discussed, integral futures work offers the greatest potential to address the two limitations I identified in the sustainable development literature (see Section 1.4.5). First, where mainstream conceptual approaches to sustainable development give insufficient attention to subjectivity, integral theory gives equal weight to objective and subjective methods. Second, integral theory has the potential to fill the theoretical gap underlying many conceptual approaches to sustainable development, providing a clear set of rules for balancing the different dimensions of sustainable development.

Returning to the specification of my research questions, there would be evident value in exploring the implications of integral theory for sustainable development and sustainable futures. Integral theory offers a theoretical approach for considering subjectivity and balancing the dimensions of sustainable development. It is a type of transdisciplinary research, capturing the benefits of transdisciplinarity I discussed in Section 1.4.4. Further, integral theory is founded on a developmental perspective, so the application to sustainable development, which also adopts a developmental perspective, appears to be a natural one. I will consider the implications of integral theory for my research questions in more detail in the next section.

1.6 Positioning the thesis

In this section, I position the thesis in relation to the disciplinary perspectives reviewed in Sections 1.4 and 1.5. To position the thesis, I use a hierarchy of aims, objectives and research questions that moves from the general to the specific. I outlined the aims of my research, in general terms, in Section 1.2.2. I will present these aims more formally in Section 1.6.1. The objectives of my research, discussed in Section 1.6.2, are more specific than the aims. They draw on the personal perspective on sustainable futures outlined in Section 1.3 and the conclusions of the literature review in Sections 1.4 and 1.5. In Section 1.6.3, I will explain and justify my choice of a particular case study to ground the research. Then, in Section 1.6.4, I will formulate specific research questions consistent with the research objectives and the chosen case study. Finally, in Section 1.6.5, I discuss the limitations of my research.

1.6.1 Research aims

I outlined the aims of my research informally in Section 1.2.2, where I lamented the slow progress in addressing civilisational challenges and moving towards a sustainable and desirable human civilisation. Here, I state these aims more formally. In my research, I will explore the reasons for the relatively ineffective human response to the civilisational challenge posed by existing environmental and social trends. In addition, I will investigate the role of the concept of sustainable development in guiding a response to the civilisational challenge and will consider ways in which the theory and practice of sustainable development might be strengthened. Ultimately, I am concerned with proposing an improved basis for practical policy action by governments, organisations and individuals to meet the civilisational challenge and move closer to a sustainable and desirable human civilisation.

1.6.2 Research objectives

The aims discussed above are clearly very broad, and do not provide sufficient focus for a research project. The purpose of the discussion and review in Sections 1.3, 1.4 and 1.5 was to provide additional focus for my research and point towards specific research objectives and questions. From these sections, I have drawn some tentative conclusions that I will use to define the objectives of the thesis. These conclusions are summarised below.

First, mainstream conceptual approaches to sustainable development focus primarily on material kinds of development, including technological, economic and institutional development. They give little attention to the social construction of reality and the influence of subjective values on the types of development that are pursued. Individual values vary, in ways that are culturally mediated, resulting in very different conceptions of what sustainable development should entail. Attempts by social scientists to introduce subjectivity into theories of sustainable development have been disjointed and have not penetrated mainstream understanding of sustainable development. There is an evident need for a theoretical and practical approach to sustainable development that engages with both objective and subjective ways of knowing reality.

Second, sustainable development has multiple dimensions that are difficult to balance in practice. For example, conflicts between economic, environmental and social objectives hamper many practical attempts to achieve sustainable development. In addition, although sustainable development is often assumed to have three dimensions (economic, ecological and social), there is no theoretical basis for this assumption. There would be evident value in providing sustainable development with a stronger theoretical foundation that could assist in identifying the important dimensions of sustainable development and guiding the resolution of conflicting objectives.

Third, my review of the futures literature indicates that FS has devoted much attention to issues of subjectivity in recent years, prompted partly by the limitations of objective approaches when faced with future uncertainty and partly by the tendency for future-oriented work to draw on a wider range of disciplines. It is apparent that the transdisciplinary approaches used by futurists to address subjectivity have much to offer conceptual approaches to sustainable development. While there has already been some interaction between the sustainable development literature and futures literature, there is scope for further engagement.

Finally, within the futures literature, the emerging field of integral futures work is the most directly concerned with the epistemological task of integrating objective and subjective knowledge. Integral theory seems to offer a way to address several of the limitations of mainstream approaches to sustainable development. However, although integral philosophy offers much in theory, its practical applications are only now starting to be explored. Richard Slaughter and his colleagues at the Australian Foresight Institute have begun to explore the implications of integral theory for futures work. In addition, an Institute for Integral Sustainability has been specifically established under the auspices of the Integral Institute to explore the implications of integral theory for sustainability and sustainable development (Barrett Brown 2004, pers.comm., 24 March). However, initial attempts to explore the theoretical (e.g. Boyle, Thomas & Wield 2000; Maiteny 2000) and practical (e.g. Owens 2002) implications of integral theory for sustainable development leave much scope for further research. At the time of writing, no definitive statement of an integral approach to sustainability has emerged. In particular, the links between integral theory and practical policy action on specific issues relevant to sustainable development remain largely unexplored. The practical value of integral theory remains an open question, suitable for further research.

Drawing on these conclusions, I have established four specific objectives for the research reported in this thesis:

1. Elaborate the links between sustainable development, futures studies and integral theory.
2. Contribute to the theoretical development and practice of each of these fields.
3. Propose an integral approach to the task of establishing a sustainable and desirable human civilisation.
4. Test the practical value of integral theory using a specific case study of an issue that is central to existing debate over sustainable development.

The hypothesis embedded in these research objectives is that an integral approach offers a better orienting framework for human civilisation than existing frameworks, with the potential to guide creative and innovative solutions to the civilisational challenge outlined in Section 1.2. Existing frameworks, such as that provided by neo-classical economic theory, emphasise economic growth, consumption and efficiency at the expense of other values, like happiness and personal development. That these frameworks are not working is clear from the brief summary of environmental and social trends in Section 1.2. Few people have the time or inclination to step back from the concerns of everyday life and ask whether a better, more fulfilling civilisation is possible. Integral theory is one attempt to step back and develop a more complete map of human possibilities and the human predicament. Whether this map will provide a better way forward remains an uncertain hypothesis. In this thesis, I gather evidence for and against this hypothesis using a specific case study of a contested policy area. It is to the choice of this case study that I now turn.

1.6.3 A case study on Australian energy and climate policy

Advocates of sustainable development are grappling with numerous difficult issues, including biodiversity depletion, climate change, soil degradation, water and food scarcity, widespread poverty and inequity and terrorism. Any one of these, and numerous other issues, would provide a suitable case study to test the application of an integral approach to sustainable futures. I have chosen to focus on global climate change in this thesis. My justifications for this choice are as follows.

First, a changing climate has the potential to exacerbate many of the other environmental and social problems that threaten the sustainability of human civilisation. In a warmer world, according to the most recent assessment report from the Intergovernmental Panel on Climate Change (IPCC 2001a, pp.82-87), there will be increasing pressure on biodiversity, agricultural viability and availability of water resources. In addition, the IPCC (2001a, p.916) expects a disproportionate share of the impacts of climate change to occur in developing countries, thereby worsening existing problems of poverty and debt. If humanity does not successfully address climate change, then action to address many other problems may be in vain.

Second, the impacts of climate change could be catastrophic for human civilisation and natural systems. The IPCC (2001c, p.82) notes the potential for changes in the climate to trigger extreme events, including a 'large climate-induced increase in greenhouse gas emissions from terrestrial ecosystems, a collapse of the thermohaline circulation, [or] disintegration of the Antarctic and the Greenland ice sheets'. While the risk of such events is low, the consequences would be severe; clearly, such events threaten a sustainable and desirable human civilization.

Third, climate change is an issue plagued by scientific uncertainty. While the great majority of scientists argue that global warming is already occurring, and that human activities are at least partly responsible, some scientists claim that global warming is a wholly natural phenomenon. Others claim that it is not occurring at all. Amongst those who agree that climate change is occurring, there is little agreement on what the future impacts might be, and how best to address those impacts. This uncertainty challenges existing decision-making frameworks that rely on expert scientific and economic advice. Further, it tends to draw out the multiple conflicting values that exist in society. In many countries, such as Australia and the United States, uncertainty has created a kind of "policy paralysis", and weakened international climate change treaties (i.e. the Kyoto Protocol). An integral approach may offer a way forward for climate change policy.

Fourth, the global nature of climate change challenges existing forms of governance. The current global political system of independent nation-states did not evolve to cope with problems that do not recognise national boundaries. Climate change introduces issues of development, equity and responsibility that extend beyond national boundaries. Consequently, new global governance structures will be required to address climate change. However, changing existing governance structures will be extraordinarily difficult. The development of such structures will influence the development of the global economy, challenge the relevance of the nation-state and shape relationships between rich and poor around the world. Indeed, it is not unreasonable to argue that the solution to climate change will require the emergence of the first truly global system of governance. In this sense, climate change is a test case for the viability of a global human civilisation.

Fifth, several authors argue that climate change and sustainable development are separate discourses that are in need of integration (Beg et al 2002; Cohen et al 1998; Swart, Robinson & Cohen 2003). The climate change discourse has pursued an instrumentally rational agenda of emission reduction and only recently begun to respond to broader issues of development, equity and sustainability. By considering both climate change and sustainable development in this thesis, I hope to contribute to the integration of these separate discourses. In fact, this constitutes a fifth research objective:

5. Contribute to the integration of climate change and sustainable development discourses.

Clearly, climate change is a particularly important challenge to a sustainable and desirable human civilisation, and therefore provides a suitable case study for the application of an integral approach. To further ground the case study, I will focus specifically on the contribution of energy consumption to climate change, in an Australian context. Energy consumption is the major contributor to global greenhouse gas emissions, and is responsible for numerous other environmental and social impacts that threaten a sustainable future. Australia is one of a handful of industrialised countries that has so far refused to ratify the Kyoto Protocol on the grounds of "national interest", and therefore provides an interesting study in the conflicts between global and national objectives.

Finally, I intend the case study to facilitate a practical focus on policy and action. While the development of theoretical and conceptual frameworks for sustainable development is important, it is also crucial, considering the urgency of the civilisational challenge discussed in Section 1.2, that such frameworks translate readily into action. Therefore, I focus in the case study on actions that governments, organisations and individuals can take to move towards sustainable futures. Given the important role of governments in guiding and facilitating actions by organisations and individuals, this implies significant attention to government policy development.

1.6.4 Research questions and thesis summary

In this section, I reformulate my research objectives as specific research questions, consistent with the case study discussed in Section 1.6.3. These research questions help to structure the thesis and guide the content of each chapter. I list each research question below and identify the chapters that focus most closely on each question. This section also provides a brief summary of the remainder of the thesis.

In this chapter, I have already begun to address my first research objective from Section 1.6.2 by starting to explore some of the links between the sustainable development literature, the futures literature and integral theory. In Chapter 2, I continue to address this research objective and begin to address the second and third objectives by summarising and interpreting the aspects of integral theory that are relevant to an inquiry into sustainable futures. I draw on this summary to propose an integral approach to sustainable futures that addresses some of the theoretical and practical limitations of mainstream conceptual approaches. I also devote considerable attention to selection of methods for the remainder of the thesis that are consistent with integral theory. The guiding research questions in Chapter 2 are:

1. How does integral theory relate to existing conceptual approaches to sustainable futures?
2. What are the theoretical and methodological implications of integral theory for sustainable futures research?

In Chapter 2, I argue that a prerequisite for an integral methodology is adequate attention to each of the four methodological categories recognised by integral theory. That is, any problem must be considered from a behavioural, social, psychological and cultural perspective to provide the foundation for an integral approach. Therefore, in Chapters 3 and 4, I review the literature on energy and climate change to determine whether these four perspectives are adequately considered. One of the objectives of the literature review is to identify existing perspectives that should be included in an integral response to climate change. A second objective is to introduce energy and climate change concepts that are used in later chapters.

In general, Chapter 3 focuses on the objective quadrants (behavioural and systemic perspectives) and Chapter 4 focuses on the subjective quadrants (psychological and cultural perspectives), although these distinctions are not rigid. The guiding research questions are:

3. How adequately does the literature on energy and climate change consider and integrate the different quadrant perspectives?
4. What behavioural, systemic, psychological and cultural perspectives need to be considered for an integral response to climate change?

My conclusion from the literature review is that the four perspectives are generally well covered in the literature, although there are some evident gaps and there has been little attempt at integration across perspectives.

In Chapter 5, I turn from literature to practice by undertaking a critical review of Australian energy and greenhouse policy. I examine the limitations of existing policies and practices, consider the extent to which the different quadrant perspectives are included in policy development processes and begin to address some of the research gaps identified in the literature review. The guiding research question is:

5. How adequately do Australian energy and climate policy development practices consider and integrate the different quadrant perspectives?

My conclusion from the policy review is that Australian energy and climate policy development practices do not facilitate inclusion of diverse subjective perspectives or the development of mutual understanding.

In Chapters 6 and 7, I address two more gaps in the literature – one apparent from an objective perspective and one apparent from a subjective perspective. Chapter 6 is concerned with the apparent higher cost of renewable energy technologies when compared to fossil fuel technologies. International literature indicates that financial subsidies to fossil fuel technologies significantly distort energy markets in many parts of the world, in favour of those technologies. However, the extent of these subsidies in Australia has been unclear, despite some earlier work. Therefore, in Chapter 6, I adopt an objective perspective to test a hypothesis that existing energy and transport subsidies in Australia distort energy markets in favour of fossil fuel technologies. The relevant research question is:

6. Does the existing system of energy and transport subsidies in Australia create a significant market distortion in favour of fossil fuel production and consumption?

In Chapter 7, I address a more theoretical problem from the existing literature. In the literature review in Chapter 4, I find that climate policy discourse analysis has contributed valuable insights into the diverse worldviews that participate in the climate change debate. However, the cultural theories used to identify these discourses either do not consider developmental theories, or are openly hostile to those theories. Therefore, in Chapter 7 I seek a rapprochement between cultural theories of discourse and the integral theory of development. The central research question is:

7. How can integral theory contribute to theoretical and practical understanding of environmental and climate policy discourse?

In Chapter 8, I propose an integral policy development practice that addresses some of the evident limitations in the literature and in existing policy development processes. I draw on the findings of the previous chapters and some additional theoretical work to propose an integral approach to policy development in the energy sector. The central research question is:

8. How can integral theory be used to improve energy and greenhouse policy development processes and outcomes in Australia?

Finally, in Chapter 9, I summarise the findings of my research, draw on the climate change case study to propose an integral approach to sustainable futures, discuss the limitations of the research, and identify future research directions. That is, I return to my original research objectives and discuss findings that are relevant to those objectives.

1.6.5 Limitations of my research

An important aspect of an integral approach to research, and indeed any good research, is awareness of limitations and boundaries. The research I present in this thesis has several important limitations. First, I concentrate on the development of theoretical and conceptual frameworks for an integral approach to sustainable futures. My research task is primarily one of integration and synthesis, rather than one of empirical testing and evaluation. I hope to apply the theoretical framework outlined in this thesis in future research projects to identify practical limitations and further refine the theory. In particular, I have been actively engaged over the past year in identifying opportunities to implement aspects of the policy approach proposed in Chapters 8 and 9. The theoretical framework and policy proposals I describe in this thesis should therefore be interpreted as a first iteration in the ongoing process of developing an integral approach to sustainable futures.

Second, consistent with my theoretical and conceptual focus, my research did not involve significant primary data collection, except to explore and verify points of particular interest. Rather, I focus on integrating secondary data sources. I have adopted this approach based on a conviction that the project of synthesis and integration is much more pressing at this time than additional data collection. The fragmentation of knowledge associated with traditional disciplinary expertise has been well documented elsewhere (e.g. Norgaard 2004, pp.231-232; Saul 1993). Works of synthesis, integration and transdisciplinarity are crucial if humanity is to find solutions to complex global problems, like sustainability and climate change.

Finally, the integrative focus and broad scope of my research means that the depth of engagement with each of the theories and concepts I consider is necessarily less than that of a more traditional disciplinary thesis. In some instances, I would have liked to consider additional theories and concepts, but this would have been too ambitious for a doctoral thesis that was already attempting much. For example, in Section 1.4, I consider a selection of theoretical approaches to sustainable development, focusing particularly on mainstream theories; I do not attempt a comprehensive review of approaches to sustainable development. This reduced engagement with particular fields is, I believe, the price of adopting a transdisciplinary, integrative approach. However, there is scope to build on this research in future by engaging more thoroughly with relevant concepts, such as additional approaches to sustainable development.

2. An Integral Theory and Method for an Inquiry into Sustainable Futures

I swear the earth shall surely be complete to him/or her who shall be complete. The earth remains jagged and broken to him/or her who remains jagged and broken.

- Walt Whitman, *Carol of Words*

Everybody is right…but partial. Nobody is smart enough to be right all the time and nobody is smart enough to be wrong all the time.

- Ken Wilber

2.1 Introduction

In this chapter, I address the following research questions:

- How does integral theory relate to existing conceptual approaches to sustainable futures?
- What are the theoretical and methodological implications of integral theory for sustainable futures research?

I start, in Section 2.2, by examining the origins of integral theory and reviewing relevant aspects of the integral map of reality. In Section 2.3, I devote considerable attention to interpretation of the integral theory of development, given its evident importance for theories of sustainable development. Then, in Section 2.4, I explore the implications of integral theory for an investigation of sustainable futures and propose an integral approach to sustainable futures research that addresses some of the theoretical and practical limitations of mainstream conceptual approaches. In Section 2.5, I discuss my choice of methods for the remainder of the thesis. Finally, in Section 2.6, I conclude with a summary of my theoretical perspective and methodological approach.

2.2 An integral map of reality

The philosophical works of Ken Wilber (e.g. Wilber 1999, 2000a, 2000b, 2000c, 2001, 2002) are recognised as the primary reference on integral theory. They demonstrate an unrivalled talent for epistemological integration, summarise key points from a remarkably diverse literature and provide approachable interpretations of difficult philosophical works by other authors. However, despite the undoubted importance of Wilber's contribution, integral theory is not the work of one man. Other theorists, from Eastern and Western traditions, are responsible for much of the foundational work in integral theory. Prominent authors whose work provides support for integral theory include Jurgen Habermas (e.g. 1979), Arthur Koestler (e.g. 1989), Jean Gebser ([1949] 1985), Jean

Piaget (e.g. [1929] 1973), Robert Kegan (e.g. 1982; 1994), Don Beck and Christopher Cowan (Beck & Cowan 1996) and Lawrence Kohlberg (e.g. 1984), to name a few.

In addition, particularly since the publication in 1996 of *Sex, Ecology, Spirituality* (Wilber 2000c), integral theory has developed into a lively field of inquiry with numerous contributors from diverse disciplines across the world. Much of this recent work has focused on theoretical and practical applications of integral theory to specific disciplines, resulting in new fields like integral ecology, integral politics and integral business. The Integral Institute (www.integralinstitute.org), established in 1998, has accelerated the development of integral theory and its practical applications across numerous fields.

At the same time, the work of integration is proceeding under different names in other fields, from public policy (e.g. Michaelis 2003) to systems theory (e.g. Kay et al 1999) to political ecology (e.g. Norgaard 1995) to ecological economics (e.g. O'Connor 1994). While integrators and synthesists in these fields may not identify their work explicitly with integral theory, their objectives are often compatible. Consequently, there is a vast body of literature on which to draw when writing about integral theory.

In this section, I provide a summary of the integral map of reality, sufficient for the purposes of my research. No summary can do justice to the depth and breadth of work in this field. However, the fundamentals of integral theory are elegantly simple, and can be captured quite succinctly. I begin, in Section 2.2.1, by setting the scene for the emergence of integral theory with a discussion of postmodernism. In Section 2.2.2, I outline the approach used by Wilber to respond to the postmodern intellectual climate and develop the integral map of reality presented in Wilber (2000c). In Section 2.2.3, I describe the **holarchic** theory that underlies integral theory. Finally, in Section 2.2.4, I discuss the four quadrants recognised by integral theory, extending the brief introduction provided in Section 1.5.4.

2.2.1 The postmodern intellectual climate

According to Wilber (2000c, p.xi), a postmodern 'intellectual climate dedicated to deconstructing anything that crossed its path', provided much of the impetus for his formalisation of integral theory. Wilber developed his version of integral theory in an attempt to move beyond the unconstrained 'pluralistic relativism' of postmodernism. Since integral theory is partly a reaction to postmodernist thought, it is necessary to provide a brief review of the aspects of postmodernism to which integral theory is reacting.

Postmodernism is, at one and the same time, a historical period, a social condition, an intellectual movement, an ideology and a body of theory. This diversity and ambiguity is typical of postmodern thought, which consequently defies definition. Nevertheless, postmodernism does have distinguishing features. Postmodernism 'emerged in such fields as literature, art, architecture, and cultural studies' in response to perceived failings of modernism (Kahn 1999, p.195). It was given shape by a group of French intellectuals that included 'the Marxist social theorist Louis Althusser, the cultural critic Roland Barthes, the philosopher Jacques Derrida, and the historian Michel Foucault' (Butler 2002, p.6). It gave rise to deconstructive and poststructuralist theories founded on scepticism, relativity and critique (Butler 2002).[9]

As the term suggests, postmodernism is a reaction to modernism, or a break from modernism. Modernism 'consists of a rich panoply of still evolving beliefs which arose with the successes of Western science and political reorganization in Europe and North America during the past three centuries' (Norgaard 1995, pp.6-7). Norgaard (1995, p.7) identifies three tenets of modernism. The first is that Western science continually progresses, technologically and institutionally, so that human control over nature grows and future generations will be better off than present generations. The second is a belief in the application of rational, positivist science to discover objective truth, and the consequent development of technocratic approaches to public decision-making and fragmented disciplinary expertise. The third is a belief in the superiority of Western culture and the universal appeal of modern values and scientific truth. Modernity 'emphasizes grand theories that look for transhistorical truths and ethical absolutes, and appeals to hierarchy, progress, development, and reason' (Kahn 1999, p.194).

In many ways, the modern project has been wildly successful, giving rise to unprecedented scientific knowledge, technological progress, and material wealth in the Western world. However, postmodernists draw attention to the darker side of the modern project, critiquing both its assumptions and its results. The assumed universal appeal of Western values and truth, for example, is inconsistent with evidence of cultural diversity, the social construction of reality, and the crucial role of context and perspective in knowledge generation. Postmodernists therefore emphasise the relativity of truth, the reality of cultural diversity and the centrality of interpretation. Further, postmodernists deplore the modern emphasis on hierarchy and Western superiority as oppressive and marginalising.

The grand theories or metanarratives of modernism are prime targets of postmodernists, as they seek to impose and legitimise particular views of reality on those who do not share them. Indeed, Lyotard (1984, p.xxiv) defines postmodernism as 'incredulity toward metanarratives'. Examples of metanarratives include the idea of historical progress, the triumph of science, and the foundational stories of nations like the United States (and Australia), which emphasise colonial triumph and exclude indigenous perspectives (Butler 2002). Norgaard (1995) is adopting a postmodern perspective when he writes of the betrayal of development and the end of progress; the modern assumption of steady progress and development towards utopia does not hold up in a world faced with clear evidence of environmental decline and social conflict.

[9] For a discussion of structuralism and poststructuralism, see Section 2.5.5.

While the present environmental crisis has been significant for revealing the failings of modernism (Gare 1995), the concept of sustainable development has been criticised for attempting to continue the modern project of development and progress. To the extent that conceptual approaches to sustainable development attempt to universally impose a particular notion of development, these criticisms seem warranted. However, I will argue throughout this thesis for a broader interpretation of sustainable development that is sensitive to cultural diversity and other postmodern concerns.

In place of the universal truth and metanarratives of modernism, postmodernism emphasises local, contextual truths, embedded in culture. However, postmodernists embrace the relativity of truth (and other concepts) to varying degrees. At one extreme is deconstruction theory, which strongly emphasises relativity (Butler 2002, p.16; Kahn 1999, p.195). Deconstructionists, of whom the best known is Jacques Derrida, abandon concepts of truth, objectivity, logic and rationality, as these concepts are constructed in specific contexts that vary according to the culture, standpoint and predisposing intellectual framework of the subject (Butler 2002, p.16; Kahn 1999, p.195). Deconstructionists argue that universal truths or values are impossible.

Many theorists have drawn attention to internal contradictions in deconstructionist theory (e.g. Kahn 1999; Wilber 2000c). Kahn (1999, pp.195-196) summarises:

> First, deconstructionists argue against theory building, yet themselves advance a theoretical position. Second, deconstructionists seek to deconstruct the tools of logic, reason, and rationality, yet use those very tools to do so. Third, deconstructionists argue against privileging any position, yet if their theory (that holds that no theory can be true for everyone) holds for everyone, even for the person who mistakenly believes it false, then the theory does what it says cannot be done. It privileges itself.

In other words, the postmodern argument that there are no metanarratives, as advanced by Lyotard (1984), is itself a metanarrative.

Wilber (2000c; 2002; 2003d) explores the results of the theoretical contradictions of postmodern relativism in detail. Postmodernism admirably attempts to free plural perspectives from the oppressive and marginalising hierarchies of modernity. However, in so doing, it has cut these perspectives free from any grounding in objective reality or universality. The result is a multitude of context-dependent, socially constructed interpretations of reality, all of which are considered equally valid. Postmodern academics, seeking to defend their own interpretations and deconstruct all other interpretations, have contributed to a nihilistic and narcissistic intellectual climate that ironically marginalises many of the alternative voices that postmodernism attempts to free.

One response is to adopt an affirmative form of postmodernism that reduces the strong emphasis on relativity, while still arguing for the plurality of value systems (Kahn 1999; Rosenau 1992). Affirmative postmodernists argue that relativism is bounded by social or community rules and beliefs (Kahn 1999, p.199). However, as Kahn (1999, p.199) points out, this 'does little more than raise the problem from an individual to a group level'.

A limitation of both forms of postmodern theory, particularly in the context of an inquiry into sustainable futures, is their silence in the face of injustice and their disregard for nature (Kahn 1999, p.198). The deconstructionist cannot intervene to prevent violations of human rights, or the rights of other species, as he or she does not recognise universal rights. For the deconstructionist, intervention in another culture marginalises the members of that culture by imposing interpretations on them that they may not share. For many people, this aspect of deconstructionist theory is deeply troubling (Kahn 1999; Wilber 2002).

The affirmative position deals no better with issues of injustice than the deconstructionist position, as groups may adopt ethical standards that the vast majority of people disagree with. This problem can only be adequately dealt with by appealing to universal moral and ethical standards, which undermines the postmodern epistemology. According to Kahn (1999, p.202), 'social scientists need a theoretical orientation that can uncover not only differences across cultures, but the ways in which differences are embedded in a larger context of commonality'. This, in essence, is the orientation that integral philosophy attempts to provide.

2.2.2 The emergence of integral theory

In his Preface to the second edition of *Sex, Ecology, Spirituality*, Wilber (2000c, p.ix-xvi) describes integral theory as a response to the paralysing intellectual climate of deconstruction. Wilber argues that postmodernism (and poststructuralism) were positive developments in the sense that they deconstructed oppressive hierarchies, emphasised interpretation and context and embraced plural values, perspectives and epistemologies. However, postmodern plurality created new problems. If all perspectives are equally valid, then how do we live in a way that is sensitive to other perspectives? If our own actions are always context and value dependent, how do we avoid taking actions that conflict with other contexts and values? If we adopt epistemological pluralism (e.g. Healy 2003), how do we balance different epistemologies when conflicts arise? In the wake of postmodernism, some way of balancing or integrating plural perspectives was necessary so that people could continue to act in the world without marginalising alternative perspectives.

The problem, according to Wilber (2000c, p.xi), was that any attempts to balance or integrate plural perspectives were actively fought by postmodernists seeking to deconstruct anything that looked like a metanarrative. Thus, while postmodernism had admirably freed multiple perspectives and cultures from oppression, it could go no further. Wilber (2000c, p.xi) proposed a new theoretical approach called **universal integralism**: 'Where pluralism frees the many different voices and multiple contexts, universal integralism begins to bring them together into a harmonized chorus'. This is the approach I have termed **integral theory** in this thesis.

To develop this universal integralism, Wilber set out to integrate different ways of knowing (different epistemologies) in a coherent, all-encompassing framework. He attempted to 'believably weave together the many pluralistic contexts of science, morals, aesthetics, Eastern as well as Western philosophy, and the world's great wisdom traditions' (Wilber 2001, p.38). Wilber described the results of this ambitious undertaking in *Sex, Ecology, Spirituality* (Wilber 2000c), key aspects of which are summarised in *A Brief History of Everything* (Wilber 2000a) and *A Theory of Everything* (Wilber 2001).

Importantly, Wilber does not attempt to reconcile the specific detail in different epistemologies and theories. Such a task would be too vast for even the most gifted synthesist. Rather, Wilber seeks integration at the level of 'orienting generalizations', which 'show us, with a great deal of agreement, where the important forests are located, even if we can't agree on how many trees they contain' (Wilber 2000c, p.5). An example of an orienting generalisation is the recognised sequence of human moral development through preconventional, conventional and postconventional stages (Wilber 2000c, p.5). Developmental theorists may disagree over the details of these stages, and the sub-stages within each stage, but there is substantial agreement that all humans pass through these three broad stages in the course of healthy moral development (see Gilligan 1982; Kohlberg 1981).[10]

Integral theory attempts to reintroduce the idea of universality, while retaining the postmodern understanding of difference and diversity. It seeks to integrate objective and subjective ways of understanding the world into a coherent epistemological framework that responds to the ways people actually experience reality and provides guidance for breaking free of postmodern paralysis. The key to this integration is the adoption of a sophisticated developmental or genealogical theory drawing on evolutionary systems theory and an updated structuralism. The foundation of integral theory is a **holarchic** interpretation of reality, outlined in Section 2.2.3.

2.2.3 The holarchic structure of reality

In his search for a universal integralism that could address some of the limitations of postmodern pluralism, Wilber started by studying and comparing hundreds of examples of scientific, spiritual, philosophical and traditional forms of human knowledge (Wilber 2000c, p.xii-xiv). He concluded that all of this knowledge was either hierarchically structured, or could be readily translated into hierarchical terms. Even postmodernism, which seeks to deconstruct hierarchy, can be expressed (ironically) as a hierarchy in which the postmodern perspective is valued more highly than other perspectives, such as modernism (Wilber 2000c, p.xii).

Next, Wilber argues that the best possible map of reality that avoids marginalising plural perspectives is one that integrates the sum of human knowledge across all fields. In other words, Wilber argues that everyone has a piece of the truth that needs to be included in a comprehensive map of reality. Further, Wilber argues that any approach that is sensitive to plural perspectives must accept that the truths generated by these different perspectives are genuine insights into the nature

[10] I discuss these stages in more detail in Section 2.3.5.

of reality. That is, an epistemological map that integrates all human knowledge is also an ontological map: 'epistemology and ontology…are inseparable' (Wilber 2002, Sidebar G, Part I).[11] Consequently, it is not just human knowledge, but also reality that is hierarchical.

The popular understanding of hierarchy is oppressive and authoritarian; this is the type of hierarchy that postmodernists criticise, with good reason. Wilber's use of the term is quite different and, to emphasise the distinction, he often uses the terms **holon** and **holarchy**, introduced by Koestler (1989). A holon is something that, 'being a *whole* in one context, is simultaneously a *part* in another' (Wilber 2000c, p.26). A holarchy is a nested hierarchy – a hierarchy of holons. Each element in a holarchy is an integral part of an element at a higher level of complexity, while also comprising elements at lower levels of complexity:

> For example, a whole atom is part of a whole molecule; a whole molecule is part of a whole cell; a whole cell is part of a whole organism. Or again, a whole letter is part of a whole word, which is part of a whole sentence, which is part of a whole paragraph, and so on (Wilber 2001, p.40).

This terminology allows greater definitional precision. Wilber's precise argument is that the structure of the universe, and human knowledge of the universe, is holarchic; reality is composed of holons (ontologically) and the structure of human knowledge reflects this reality (epistemologically). This is not to say that holons have any pre-given existence. Instead, they are enacted or constructed by the perceiving subject, employing various epistemological approaches. I will return to this point in Section 2.2.4.

The holonic understanding of reality is not, in itself, particularly radical. Evolutionary systems theory also defines reality in terms of nested systems and some systems theorists specifically discuss holons and holarchy (e.g. Kay et al 1999; Laszlo 1996b). Indeed, Wilber (2000c, pp.41-85) draws heavily on systems theory to elaborate the implications of a holarchic view of reality, defining twenty tenets or tendencies of evolutionary, holarchic systems. I provide a complete list of these twenty tenets in Appendix A. I will discuss those tenets that are relevant to my research in the appropriate locations in the text. I have just covered Tenet 1 (reality is composed of holons).

What distinguishes Wilber's epistemology and ontology from that of systems theory is its application not only to the exterior observable aspects of systems, but also to the subjective interior structures through which humans interpret reality. In the next section, I outline the theory underlying this extension into the subjective realm.

[11] The inseparability of epistemology and ontology is one of the enduring contributions of postmodernism, which recognised that reality is constructed, not pre-given.

2.2.4 Four ways of constructing reality

According to Wilber (2000c, pp.197-198), all holons have both an exterior that can be examined objectively, and an interior that can be interpreted subjectively. At the same time, all holons by definition exist as individuals (wholes) embedded in communities or collectives (of which they are a part). The combination of these two distinctions gives four possible ways of constructing reality, which integral theorists typically represent using a quadrant diagram, as shown in Figure 2.1. The four quadrants are:

- Behavioural quadrant (upper-right in Figure 2.1): concerned with the visible exterior of individual holons, or the objectively observable behaviour and structure of organisms
- Social or systemic quadrant (lower-right in Figure 2.1): concerned with the visible exterior of collective holons, or the objective structure and dynamics of technological, economic, institutional and ecological systems
- Intentional or psychological quadrant (upper-left in Figure 2.1): concerned with the subjective interior of individual holons, or self, consciousness, personal experiences and values
- Cultural quadrant (lower-left in Figure 2.1): concerned with the shared subjective interior of collective holons, or culture, worldview and discourse.

Importantly, Wilber's quadrants are not arbitrary theoretical constructs. Rather, they are categories or perspectives that emerged from detailed study of hundreds of epistemological holarchies. The categories are embedded in language: 'Thus, the inside of the individual shows up as "I"; the inside of the collective as "you/we"; the outside of the individual as "it/him/her'; and the outside of the collective as "its/them" (Wilber 2003a, Part I). Each of the quadrants represents a different broad approach to enacting or constructing a holon.

The quadrants can also be understood as embodying different selection criteria; if a holon does not comply with these criteria it will cease to exist (Slaughter 2004, p.160; Wilber 2003a, Part II). A holon must register the external world accurately by objectively assessing *behaviour*, it must functionally fit with the supporting *social* systems in which it is embedded, it must register its internal world and *intentions* accurately and truthfully and it must achieve a degree of mutual understanding or *cultural* fit.

Further, each quadrant has its own suite of preferred methods for generating knowledge and its own community of practitioners – what Norgaard (2004, p.239) calls an 'epistemic community'. A founding principle of integral theory is that reality can only be comprehensively understood, without marginalising any of the epistemic communities, by employing all of these languages and methods simultaneously. In other words, an integral map of reality must include all quadrants. I will discuss each of the quadrants in more detail below.

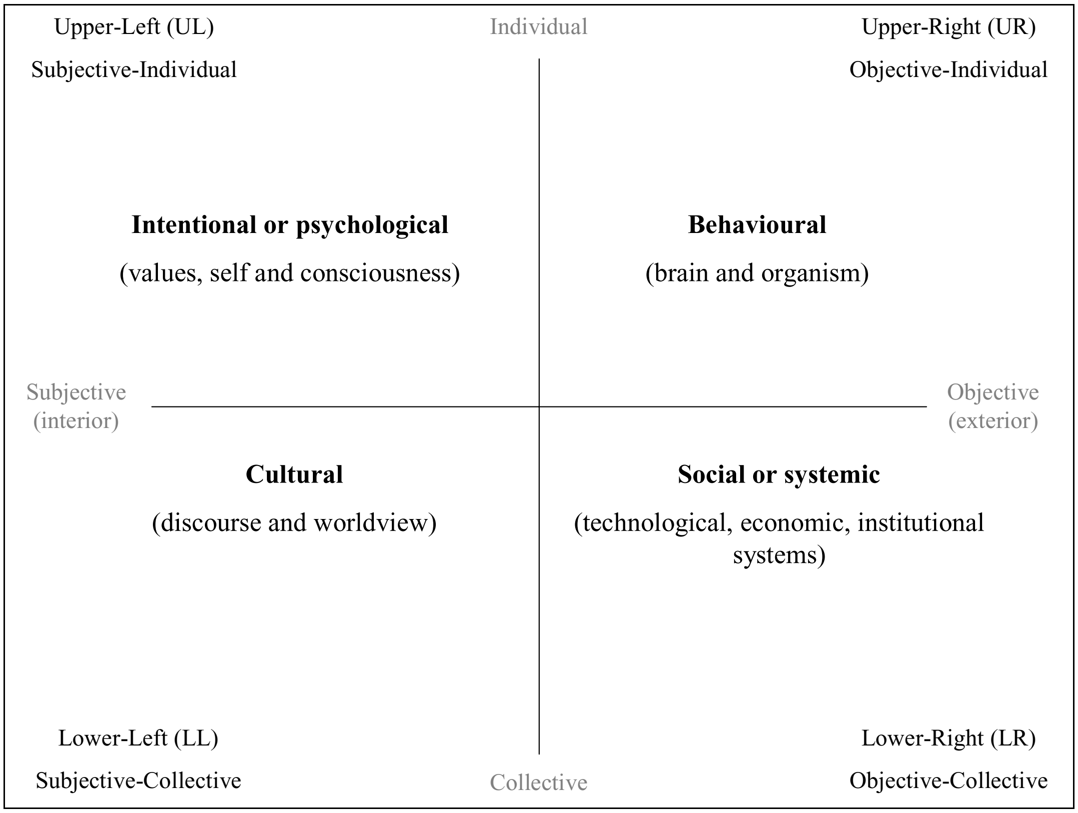

Figure 2.1: Four ways of constructing reality.

Source: Adapted from Figure 3.1 in Wilber (2001) and Figures 5.1 and 5.2 in Wilber (2000a).

The behavioural quadrant

The behavioural quadrant is concerned with the observable exterior of individual holons, from sub-atomic particles to complex organisms and brain structures. Methods in this quadrant attempt to measure what individual holons do, and how they behave, from an objective perspective. The epistemic community that has formed around the behavioural quadrant seeks to empirically determine the nature of reality by observing exterior behaviour from a position of critical detachment. The behavioural quadrant is the realm of the traditional sciences and methods: physics, biology, chemistry, behaviourism and empiricism. Knowledge of the behavioural quadrant is expressed in singular **it** language.

The social or systemic quadrant

The social or systemic or interobjective quadrant is concerned with the observable exterior of communities of holons, or the social system and environment. The subject matter of the social quadrant is:

> …any of the concrete, material, embedded social forms of communities (the exterior forms of social systems), including modes of tools and technology, architectural styles, forces of production, concrete institutions, even written (material) forms, and so on' (Wilber 2000c, p.128).

The epistemic community that has formed around the social quadrant attempts to observe how collective holons behave, or how they work. The social quadrant is the realm of the system sciences: ecology, economics, systems theory, chaos theory, complexity theory and much of the work in sociology (Wilber 2000c). Knowledge of the social quadrant is expressed in plural **its** language.

The use of the term *social* to label this quadrant can cause confusion. In common usage, and particularly in sustainable development discourse, social often refers to the broad subject matter of both the social and cultural quadrants. Wilber uses social in a narrow sense to refer to the exterior structure of collective holons. Where there is risk of confusion, I follow Hargens (2003) in referring to this quadrant as the *systemic* quadrant.

The intentional or psychological quadrant

The intentional quadrant is concerned with the interior depth and intentions of individual holons, i.e. self and consciousness. The epistemic community that has formed around the intentional quadrant investigates interior consciousness at it appears in individuals. Researchers seek to understand individual reality by directly accessing or empathetically interpreting feelings, values and personal meanings. The intentional quadrant is the realm of 'the "interior" individual sciences…from psychoanalysis to phenomenology to mathematics' (Wilber 2000c, p.128). Personal explorations of meditative states of consciousness and spiritual practices are also associated with the intentional quadrant. Sigmund Freud, Carl Jung, Jean Piaget and Gautama Buddha were prominent theorists of this quadrant. Knowledge of the intentional quadrant is usually expressed in singular first-person, or **I** language. I sometimes refer to this quadrant as the *psychological* quadrant, emphasising the crucial role of developmental psychology in revealing the content of this quadrant.

The cultural quadrant

The cultural or intersubjective quadrant is concerned with the interior depth of communities of holons, or culture and worldview. The subject matter of the cultural quadrant includes 'interpretive understandings, cultural meanings in general, collective and group identities, intersubjective moral and ethical understanding, and so on' (Wilber 2000c, p.197). The cultural quadrant is the realm of hermeneutic, interpretative and phenomenological studies of culture (Wilber 2001). Cultural theorists, such as Thomas Kuhn, Max Weber, Jurgen Habermas and Mary Douglas, investigate 'shared values, perceptions, worldviews and background cultural contexts' (Wilber 2001, p.51). They attempt to interpret shared cultural meanings. Knowledge of the cultural quadrant is expressed in plural **we** language.

2.3 The integral theory of development

In the previous section I described two of the three major elements of integral theory. The first was the holarchic nature of reality (and knowledge of reality). The second was the existence of four epistemological categories of knowledge, or four ways of constructing reality. In this section, I will address the third major element – the integral theory of development. Given that I am focusing on sustainable *development* in this thesis, it is particularly important to engage with the integral theory of development, explore some of its implications and anticipate some of the criticisms of the theory. I therefore devote considerable space to this topic, particularly in Sections 2.3.5 and 2.3.6 where I discuss the controversial topic of development in the subjective quadrants. This discussion provides a foundation for much of the subsequent work in my thesis.

2.3.1 The developmental process

A developmental or evolutionary perspective is at the heart of integral theory. According to integral theory, development is a holarchic process that creatively adds new structures to inherited structures, building new holons on previous holons (Koestler 1989; Wilber 2000c, pp.54-59). The emergent holon retains the properties and abilities of all previous holons, but possesses new emergent properties that make it recognisably different from previous holons; it transcends and includes previous holons (Wilber 2000c, pp.59-61 and Tenets 3, 4 and 5 in Appendix A).

While the developmental process is continuous, in the sense that it builds on existing structures, it is also characterised by creativity, emergence, symmetry breaks and discontinuities (Kay et al 1999; Wilber 2000c, pp.49-52). Consequently, the new developmental structures – the new holons – are qualitatively different from the previous structures. This means that development passes through recognisable stages or **levels**, each of which is more inclusive than the last. This developmental theory explains the observation, discussed in Section 2.2.3, that reality is composed of nested hierarchies or holarchies.

Integral theorists argue that the developmental process is evident in all the quadrants. The following are some examples of holarchies in each quadrant, starting with the earliest holons to emerge:

- Behavioural quadrant: atoms, molecules, prokaryotes, eukaryotes, invertebrates, fish/amphibians, reptiles, paleomammals, primates, humans (Wilber 2000c). Note that each structure includes the previous structures (e.g. cells include atoms and molecules) but possesses new emergent properties (e.g. cells have an internal metabolism that molecules do not possess).
- Social quadrant: Nolan and Lenski (1999, p.77) describe the development of the primary mode of subsistence in human society through hunter-gatherer, horticultural, agrarian and industrial stages.

- Psychological quadrant: Beck and Cowan (1996) trace the development of individual values through archaic, magic, egocentric, mythic, modern, postmodern and integral stages.[12] The developmental progression is one in which the individual's circle of care gradually expands to include a wider range of perspectives.
- Cultural quadrant: Gebser ([1949] 1985) describes a developmental progression of worldviews in human cultures through archaic, magic, mythical, mental and integral stages, moving towards greater inclusiveness.

These are just a few examples of developmental progressions; I will discuss others below. In each case, the developmental process increases complexity, the degree of relative autonomy and the degree of consciousness (Wilber 2000c, p.214, Tenets 12a and 12d and Addition 1 in Appendix A). In addition, later holons rely on all previous holons for their existence. For example, the destruction of all atoms would destroy all humans, but the destruction of all humans would not destroy all atoms (Tenet 9 in Appendix A).

Integral theorists do not characterise development as a simple linear progression through levels. Rather, development is understood as a fluid process that occurs along many, relatively independent developmental **lines**, at varying rates. Developmental lines are distinct categories of development, or distinct holarchies, identified by developmental theorists. For example, in the psychological quadrant, a sample of the recognised developmental lines includes 'morals, affects, self-identity, psychosexuality, cognition, ideas of the good, role taking, socio-emotional capacity, creativity [and] altruism' (Wilber 2000b, p.28). Some two-dozen developmental lines are currently recognised in the psychological quadrant (Wilber 2000c, p.216). I will give more examples of developmental lines from each quadrant below.

In the objective quadrants, I interpret the levels in each developmental line as relatively rigid. From an objective perspective, a holon cannot be both a human and a reptile, for example, at the same time. However, humans retain a functional reptilian brain stem that influences behaviour. Similarly, a society may be characterised as industrial, based on the primary mode of subsistence, however that society is still reliant on agriculture and horticulture. In other words, holons in the objective quadrants retain access, in some form, to earlier structures.

I interpret the developmental levels and lines in the subjective quadrants as less rigid than those in the objective quadrants. From a subjective perspective, an individual or group is not *at* a particular level. Rather, development creates probabilities that an individual or group will activate different levels and lines in different contexts. Thus, developmental theorists of the subjective quadrants discuss the probability that the behaviour of an individual or group will be consistent with a particular developmental level in a particular developmental line. The probabilities are based on

[12] These are my preferred labels for the stages, not those preferred by Beck & Cowan. I will outline my reasons for adopting these labels in Section 2.3.5.

observations of past behaviour and interpretation of interior structures. To capture the fluid and dynamic qualities of subjective development, integral theorists often refer to developmental stages as overlapping **waves**[13], and to developmental lines as **streams** that can cross, split and merge.

Whatever the terminology used, a central argument of integral theory is that all levels must be included in any comprehensive map of reality. When this argument is combined with the all quadrants argument discussed in Section 2.2.4, it gives rise to the phrase '**all quadrants, all levels**' (AQAL), commonly used to describe the integral perspective. An integral theorist attempts to adopt an AQAL perspective on any particular problem they are addressing.

It is important to note here that integral theorists do not conceive of development as a unidirectional or universally progressive process; development can involve regression, pathology and dead ends. Things can go wrong at any point, particularly at the fulcrums between developmental stages. As Wilber (2000c, p.214) notes, each new development brings 'new fears, new anxieties, new needs, new scarcities, new desires, new moral engagements in new shared worldviews, and the ever-present possibility of new and higher pathologies and distortion'. Development is an adaptive process that does not always succeed.

My understanding of development is that only those structures that are well adapted to their particular environment, whether behavioural, social, psychological or cultural, will prove sufficiently stable over the long-term to become part of a recognisable developmental progression. In other words, development is essentially a process of creative problem solving where only the successful solutions are taken up into the developmental process as abiding structures. Superimposed on these abiding structures are infinite creative variations that may or may not prove sufficiently adaptive to become part of the abiding structures. While we share deep developmental structures, there is enormous diversity in how each individual expresses these structures.

2.3.2 The three realms of evolution

Having outlined the developmental process as understood by integral theorists, in this section I will briefly describe the nature of development on a geological timescale, as this long-term perspective is important for theories of sustainable development. On this timescale, numerous theorists have identified three great domains of evolution (e.g. Laszlo 1996a; Vernadsky [1926] 1998; Wilber 2000c, p.15). Wilber refers to these domains as the physiosphere, biosphere and noosphere, and I will follow his terminology here.

The **physiosphere**, sometimes called the geosphere, is the physical realm of matter that emerged immediately after the Big Bang. For billions of years, evolution acted solely on the physiosphere, bringing forth atoms, molecules, stars, planets, galaxies, and so on. Eventually, at least on Earth,

[13] The term wave is intentionally analogous to the concept of a probability wave in quantum physics. It represents a probability that an individual (or cultural group) will behave in a particular way in a particular situation. The term acts as a reminder that interior development is not a rigid or deterministic process.

conditions emerged in which molecules were able to combine to form cells. With the development of the first cells, the **biosphere**, or the realm of life, emerged. The biosphere comprises the collective organisms and processes of life. Evolution continued in the biosphere, giving rise to numerous forms of life, and eventually to mind, consciousness and human culture. The term **noosphere** is used to refer to the realm of mind, consciousness and culture. This term was popularised by the Russian geochemist Vladimir Vernadsky (e.g. [1926] 1998) and the French philosopher Pierre Teilhard de Chardin (e.g. 1964; 1965). Literally, it means the sphere of human thought or consciousness and is composed of interacting human minds and ideas. According to integral theories of development, evolution continues in the noosphere.

The relationship between the three realms of evolution is depicted in Figure 2.2. The figure illustrates the integral understanding of development as a process of transcendence and inclusion. In this case, the biosphere transcends and includes the physiosphere and the noosphere transcends and includes the biosphere. The first cells, and all subsequent life, physically contain atoms and molecules from the physiosphere. If the biosphere did not include these elements of the physiosphere, it would not exist. At the same time, the biosphere transcends the physiosphere by adding new emergent properties. Life has characteristics that are not evident in matter alone, such as the ability to reproduce. Similarly, the noosphere includes the biosphere, in the sense that human minds and cultures can only exist as long as the biosphere continues to exist. However, the noosphere transcends the biosphere by adding new abilities such as language and art. I will provide a more detailed discussion of the emergence of the noosphere from the biosphere in Chapter 7.

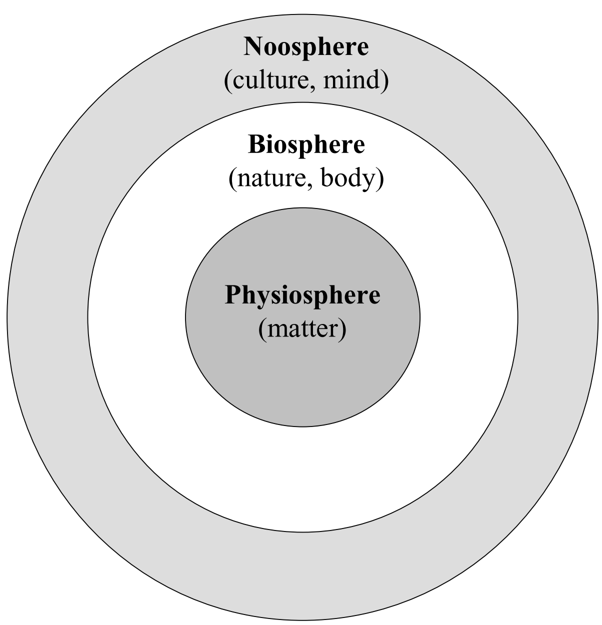

Figure 2.2: The relationship between the physiosphere, the biosphere and the noosphere.

The integral understanding of the relationship between the physiosphere, biosphere and noosphere, depicted in Figure 2.2, has important implications for theories of sustainable development. It confirms one aspect of the systems perspective on sustainable development discussed in Section 1.4.3 – human culture, the noosphere, relies on the biosphere for its survival. The minimum requirement for a sustainable human civilisation is that it complies with the rules of the biosphere (and physiosphere). However, the understanding depicted in Figure 2.2 conflicts with the common argument within sustainable development discourse that a return to nature, or an adoption of biospheric laws, is sufficient to achieve sustainability. The noosphere has fundamentally new characteristics that must be considered in any approach to sustainable development. A sustainable human civilisation must devote at least as much attention to the health of the noosphere as that of the biosphere. I will return to this point in Section 2.4.4.

In the next four sections, I will consider the developmental process from the perspective of each quadrant, outlining some of the important developmental progressions that need to be considered in an inquiry into sustainable futures.

2.3.3 Behavioural development

The behavioural quadrant is concerned with the physical structure and observable behaviour of individual holons. Developmental lines in this quadrant include 'biological growth, neuro-physiological development, [and] behavioural evolution' (Wilber 2000c, p.215). The early work of Darwin (e.g. [1859] 1982) and Wallace (e.g. 1870) on natural selection and biological evolutionary processes provided the foundation for evolutionary theory in this quadrant. Theories of biological evolution are now part of the scientific orthodoxy (e.g. Laszlo 1996a) although the details of evolutionary processes are still debated. Consequently, the integral theory of development is relatively uncontroversial in this quadrant.

The following is an example of a developmental progression in the behavioural quadrant, focusing particularly on brain structure and broad taxonomic classifications. The labels are drawn from Wilber (2000c, p.198). I have added my own examples or explanations in parentheses.

- Atoms
- Molecules
- Prokaryotes (unicellular organisms)
- Eukaryotes (multicellular organisms)
- Neuronal organisms (invertebrates)
- Neural cord (fish/amphibians)
- Reptilian brain stem (reptiles)
- Limbic system (paleomammals)
- Neocortex or triune brain (primates)

- Complex neocortex (humans).

Each successive level of development builds on the previous, increases complexity, and adds new characteristics. For example, the reptilian brain provides 'rudimentary sensori-motor intelligence and instinctive drives or impulses' (Wilber 2000c, p.103). The paleomammalian brain retains the abilities (and physical structures) of the reptilian brain, but adds the limbic system, allowing mammals to experience visceral sensations, emotional reactions and feelings (Wilber 2000c, pp.103-104). Similar progressions are evident for other developmental lines, such as evolution of behaviour.

2.3.4 Social or systemic development

According to the integral theory of development, the exterior structure of collective holons develops along numerous lines through recognisable stages or structures. That is, it is not just individuals that develop, but whole systems. Development theorists in this quadrant examine the historical development of, for example, architectural forms, modes of transportation, modes of communication, weapons, ecosystems, 'techno-economic forms, geopolitical structures…[and] social systems' (Wilber 2000c, p.215). Development in this quadrant generates increasingly connected technological, economic and institutional structures.

Like theories of biological evolution, theories of social or systemic evolution are relatively uncontroversial. Nolan and Lenski (1999) provide a useful example of a social developmental progression in their classic introductory text on macrosociology, now in its eighth edition. Nolan and Lenski (1999, p.77) identify historical eras in the development of human societies based on the primary subsistence technology employed by the society:

- Hunting and gathering era, from human beginnings to about 8000 B.C.
- Horticultural era, from about 8000 B.C. to about 3000 B.C. (with simple and advanced sub-stages)
- Agrarian era, from about 3000 B.C. to about 1800 A.D. (with simple and advances sub-stages)
- Industrial era, from about 1800 A.D. to the present.

Of course, this developmental sequence is a simplification. First, there are identifiable stages of social development before humans emerge (e.g. insect societies with division of labour). Second, there are many developmental lines that are not considered when focusing only on modes of subsistence – attention to these developmental lines may indicate alternative historical categories. Third, I have not listed all of the categories identified by Nolan and Lenski; they also identify fishing, herding and maritime societies that have arisen in response to particular environmental conditions but do not occur in the typical developmental progression. Finally, examples of these societies are not confined to the era indicated – all of these societal types exist today alongside each other. Bearing in mind these qualifications, the basic developmental progression in the primary mode of subsistence matches the historical evidence.

Consistent with integral theories of development, each new subsistence mode builds on and includes the previous, but adds new abilities. Hunting and gathering societies survive by hunting wild animals and foraging for uncultivated plant foods. Horticultural societies may still employ hunting and gathering, but also cultivate plants, using human labour. Agrarian societies continue to cultivate plants but use ploughs and animal power to increase the efficiency of cultivation. Industrial societies still employ agriculture, but also use machine technology and inanimate sources of power.

Two other general trends in the development of human societies are worth noting here. First, the median size of societies has increased over time. That is, human social structures have developed over time to physically include a greater number of people within social groupings. Hence, there is an identifiable developmental progression, parallel to that described by Nolan and Lenski, from small nomadic tribes, to villages, to city-states, to empires, to nation states and now towards a planetary civilisation (Wilber 2000c, p.198). Second, the complexity of social systems has increased over time, as evidenced by trends in occupational specialisation and the complexity of status systems (Nolan & Lenski 1999).

Transcendence and inclusion in social development occurs not through the unaltered retention of earlier systems but through retention of the abilities provided by those systems. For example, modern agricultural systems bear little resemblance to those developed by early agricultural societies. Differences have developed gradually over time as new innovations creatively emerged. Thus, it is not agriculture in its original form that is included through the developmental process. Rather, it is the ability to support large numbers of people without all of those people having to work as farmers that has been retained in modern society. This new ability supported the development of city-states and provided a source of labour for the eventual emergence of industrial society.

I will return to the historical development of technological, economic and institutional systems in Chapter 3, as global environmental problems like climate change are linked to characteristics of these systems.

2.3.5 Psychological development

Integral theories of development in the intentional quadrant draw on a body of psychological theory variously labelled as the constructive-developmental tradition (e.g. Kegan 1982), structural-developmental theory (e.g. Kahn 1999), constructivist learning theory, or simply structuralism (e.g. Wilber 2003d). Structural-developmental theory in the intentional quadrant owes much to Jean

Piaget's work on cognitive development in children (e.g. Piaget [1929] 1973). Kahn (1999, p.61) provides a 'common sense' summary of structural-developmental theory:

> People construct conceptual knowledge. Those constructions are mentally organized. We can call those mental organizations structures. Structures develop. Through structural development early forms of knowledge do not disappear, but are transformed into more comprehensive and adequate ways of understanding the world, and of acting upon it.

In other words, development in the intentional quadrant is a process of building new insights on earlier conceptual structures. As noted in Section 2.3.1, integral theorists typically refer to these structures as developmental levels or waves. Individual consciousness emerges from the presence and interaction of these developmental waves, simultaneously shaped by factors in the behavioural, systemic and cultural quadrants.

Piaget on structural development

Piaget's experimental work with children was pioneering in its identification of the cognitive structures that a child uses to frame his or her understanding of the world. Here, I draw on Kahn's (1999, pp.48-58) discussion of Piaget's work. As a child develops, he or she is confronted with environmental phenomena that cannot be readily accommodated by his or her existing cognitive structure. The failure of the existing cognitive structure is disconcerting for the child and introduces a sense of disequilibration (or cognitive dissonance). To resolve this disequilibration, the child experiments, learns, and creatively constructs new knowledge that more adequately explains the environmental phenomena. A new cognitive structure is built on the foundation of the old. Development is thus a process of hierarchical integration where 'later structures reflect increasingly adequate transformations of earlier structures' (Kahn 1999, p.54).

Wilber (2000c) and Kegan (1982, p.77) use similar terminology, arguing that psychological development is a process of differentiation and integration. Differentiation is the emergence or recognition of a new developmental structure; integration is the process of incorporating that new structure into the self. Wilber gives an example from early child development that helps to illustrate this process. At birth, a child 'cannot easily distinguish between subject and object or self and material environment' (Wilber 2000c, p.219). It is only when the child learns to *differentiate* his or her physical body from the physical environment that the next stage of development can occur. This differentiation occurs through active experimentation: 'The infant bites its thumb and it hurts, bites the blanket and it doesn't. There is a difference, it learns, between the physical self and the physical other' (Wilber 2000c, p.219).

Further, the next stage of development only occurs if the individual is able to *integrate* (transcend and include) the new insights provided by differentiation. Continuing the above example, the infant must learn that physical objects exist independently and that he or she cannot influence them mentally. A failure to integrate the new insights generally results in pathology. The type of pathology is specific to the particular stage of development that the individual is attempting to integrate. For example, failure to adequately integrate the recognition that the self is separate from the physical environment usually leads to psychosis (Wilber 2000c, p.219).

Other developmental lines

Piaget's structural-developmental work focused on cognitive development of children. Other theorists (e.g. Kegan 1982, 1994) have shown that the same processes of development continue into adulthood. Further, the evidence for structural development is consistent across numerous lines or streams of psychological development. For example, Kohlberg (e.g. 1981; 1984) identifies hierarchically integrated waves of moral development, Maslow ([1954] 1987) describes hierarchical development of human needs, and Loevinger (e.g. Loevinger & Blasi 1976; Loevinger, Wessler & Redmore 1970) describes hierarchical development of ego identity.

Wilber (2000b) reviews the work of numerous developmental psychologists and finds a surprising degree of agreement on the general concept of hierarchical structural development, even though the specific characteristics of developmental lines and structures are hotly contested. Similarly, Kahn (1999, p.55) argues that the study of development using structural-developmental analysis remains highly influential, despite worthy critiques of the structures identified by particular theorists. Structural-developmental theories are certainly not the only theories of psychological development (see Kahn 1999, pp.46-48, for an outline of three other theories) but they are accepted as a valid basis for theoretical and empirical work.

Wilber identifies at least two dozen developmental streams in the intentional quadrant, including 'cognitive, moral, interpersonal, affective/emotional, needs, self-identity, object relations, and values' (Wilber 2003d, p.79). According to Wilber (2003d, p.93), the common thread in all of these streams is that healthy[14] development moves towards a greater degree of consciousness or awareness, within the specific capacity that the stream represents. I will give a few examples of developmental lines below, focusing specifically on humans. I will draw on these examples throughout the thesis.

[14] In this thesis, judgements about **healthy** and **unhealthy** forms of development are based on the work of the epistemic communities studying the particular kind of development. I believe that it is one of the roles of an epistemic community to identify unhealthy developments. Thus, for example, psychologists are responsible for identifying pathologies occurring during psychological development, cultural theorists are responsible for identifying unhealthy cultural tendencies, medical practitioners are responsible for identifying pathological changes during biological development and system theorists are responsible for identifying trends that threaten system viability. More broadly, integral theorists argue that healthy development is development that proceeds holarchically towards a greater degree of inclusion across all quadrants.

Cognitive development

In simplified terms, Piaget identifies four overarching stages of cognitive development: sensori-motor, preoperational, concrete operational and formal operational. These stages show increasing capacity for synthesis and abstraction (Kahn 1999, p.52). At birth, a child acts primarily on impulse and emotion. During the **sensori-motor** stage, the child learns to recognise sensations and images but does not yet assign symbolic associations to these sensations. At the **preoperational** stage, the child first begins to assign symbols to particular images, such as using words to represent specific objects. As the preoperational stage continues to unfold, the child learns to combine different symbols into concepts. Whereas a symbol represents a specific object, a concept represents a class of objects; that is, concepts transcend and include symbols. The **concrete-operational** stage (occurring around age 7 to 11 years) is characterised by an ability to take the role of the *other* and to apply rule-based thinking. Rules are ways of relating different concepts, so rules transcend and include concepts. The **formal-operational** stage is characterised by an ability to reflect on one's own thought processes and on the rules that constitute social norms (Wilber 2000c, p.240). Compared to concrete operational cognition, formal operational cognition is 'more abstract (in the sense of being applicable to more and more situations), and thus more universal' (Wilber 2000b, p.26). It is rationality of the type that came to prominence during the European Enlightenment. Many researchers have identified postformal stages, such as Wilber's **vision-logic** (Wilber 2000b, 2000c). I will have more to say about these postformal stages in Chapters 7, 8 and 9.

Moral development

Turning to the moral developmental line, Wilber (2001, p.21) identifies a basic developmental progression from a **preconventional** or **egocentric** stage, through a **conventional** or **ethnocentric** (or sociocentric) stage, to a **postconventional** or **worldcentric** stage. At each stage, the individual broadens his or her circle of care – from the self, to his or her immediate society or culture, to all people and all cultures. The individual continues to care for those that he or she cared for at the previous level, but extends his or her care to a wider circle, transcending and including the previous stage. From this perspective, moral development is a process of decreasing egocentrism (Wilber 2000b, pp.116-117). Of course, these stages are very general; different theorists label the stages differently, and often identify additional stages within these categories. In addition, Kahn (1999) discusses compelling evidence for different types of morality – obligatory and discretionary morality – that apply in different situations. It therefore appears likely that moral development occurs along multiple lines, rather than the single line discussed as an illustration by Wilber (2001).

Development of values

Beck and Cowan (1996) draw on the work of Clare W. Graves (e.g. Graves 1981) to describe the development of values through eight stages. The stages they describe are widely used by integral theorists (e.g. Wilber 2001, pp.7-13). They refer to these stages as 'value memes' or 'v-memes', where 'a meme is simply *a basic stage of development that can be expressed in any activity*' (Wilber 2001, p.7). While I find the stages identified by Beck and Cowan very useful, I find their use of the term meme problematic. The concept of the meme in cultural evolution is commonly used as analogous to the gene in biological evolution (e.g. Blackmore 1999; Dawkins 1990). However, I do not believe that values can be transmitted like genes. Meme is a poor choice of terminology to describe psychological stages that can only be achieved through developmental processes. I therefore avoid this particular aspect of Beck and Cowan's terminology in my work.

In addition, Beck and Cowan (1996) assign colours to the different value memes they identify. During the course of my research, I have presented early versions of my material to various audiences. In all cases, the audience members found the use of colours to describe the different value stages disconcerting. Consequently, I prefer to use one-word labels for the different value stages and avoid the use of colour labels. In addition, for the purposes of my work, it is convenient to combine the last two stages described by Beck and Cowan (1996) into a single stage, as the distinction between these two stages has little relevance for research focused on current policy practice.[15] The brief stage descriptions below draw on Beck and Cowan (1996), summaries of their work by Wilber (2001, pp.7-13) and my own interpretations. The seven value stages are:

- *Archaic*: the individual is focused on survival and satisfaction of basic needs for food, water, warmth, sex and safety. Archaic values predate the emergence of human language and culture, but are still evident today in newborn infants.
- *Magic*: the individual seeks harmony and safety in a world full of magical spirits. Magical or animistic values are evident in many tribal cultures and in some New Age beliefs.
- *Egocentric*: the individual seeks to impose his or her ego on others and exercise personal power and strength, often violently. Egocentric values are the basis of, for example, feudal empires.
- *Mythic*: the individual looks for meaning, order and direction through adherence to a higher purpose and absolute laws. Mythic values, as the name suggests, are often religious, and usually support the establishment of rigid social hierarchies.

[15] Specifically, I use the label **Integral** to capture the stages that Beck & Cowan label 'systematic-integrative' (yellow) and 'global-holistic' (turquoise). As I will explain in Chapters 7 and 8, the problem for sustainable development policy in Australia is primarily one of reaching and moving beyond postmodern values. The details of the sub-stages after the postmodern value stage are not yet particularly important for an integral policy approach.

- *Modern (or rational)*: the individual uses rational analysis and strategic thinking to seek personal prosperity and achievement in the marketplace. Modern values began to emerge, on a widespread basis, during the Enlightenment and underpin rational scientific methods. They are the most common value set today, and the basis of today's corporate states.
- *Postmodern (or ecological)*: the individual values pluralism, human equality, ecological and cultural sensitivity, and exploration of the inner self. Postmodern values are strongly egalitarian, relativistic and anti-hierarchical. They are evident (in different forms) in the environmental movement and postmodern intellectual movements.
- *Integral*: the individual recognises the existence of natural hierarchies (holarchies) and nested systems, placing him or her in conflict with anti-hierarchical postmodern values. For the individual acting according to integral values, all quadrants and all developmental waves are valuable and need to be integrated in a comprehensive theory and practice.

I will return to psychological development in Section 2.5.4, where I will outline the use of structuralism to identify developmental structures in the intentional quadrant. I will also consider some of the developmental streams described above in more detail in Chapters 4 and 7, particularly as they relate to the development of environmental attitudes and discourses on climate change.

2.3.6 Cultural development

The most controversial aspect of the integral theory of development is its application to the cultural quadrant. As Wilber (2000b, p.147) puts it: 'Evolution in the cultural domain is a sensitive topic, with potential for abuse when not handled with care'. As discussed in Section 2.2.1, postmodernists and cultural theorists argue that different cultural perspectives are all equally valid and that labelling a cultural worldview as less developed effectively marginalises that worldview. They argue that integral theory is a meta-narrative that imposes its interpretations on others.

Wilber (2002, Sidebar A) shows in recent work that these criticisms are misplaced. In fact, integral theorists accept that there are multiple cultural perspectives, and that all of these perspectives are valuable. Instead of imposing interpretations on others, integral theory seeks to develop interpretations that members of a culture would themselves agree with. However, integral theory also examines how cultural perspectives have changed over time, using historical or genealogical methods. These methods indicate that the development of exterior social structures to support increasing human populations has been paralleled by development of shared interior structures to support wider cultural membership (Habermas 1979). According to Wilber (2000b, pp.147-148), 'the evidence for [cultural evolution] continues to mount, and numerous theorists have embraced it in qualified forms'.

Below, I explore the integral perspective on cultural development, using an example of the development of average cultural worldviews during human history to illustrate. In Section 2.5.5, I will discuss the methods used to study and reveal stages of cultural development, particularly the application of structural methods to the cultural quadrant. In Chapter 7, I will explore the relationship between cultural theory and integral theory at length, using a case study on climate policy discourse.

Wilber (2000c, p.153) follows Habermas (1979) in arguing that 'the same structures of consciousness…can be found in the individual self [psychological quadrant] and its cultural setting [cultural quadrant]'. That is, the stages that are evident in cultural development have the same basic structure as the stages observed in individual psychological development; the individual and cultural structures are isomorphic (Wilber 2003d, p.99). In addition, Wilber and Habermas both argue, based on a compelling body of theoretical and empirical evidence, that the structures of consciousness observed today in individual psychological development are a recapitulation of stages that progressively emerged during the cultural evolution of the species (Habermas 1979, pp.98-99; Wilber 2000c, pp.153-156). Wilber (2000c, pp.155-156) is careful to point out that the parallels between the stages of psychological development and the stages of cultural development are not rigid; rather, they comprise broad similarities between abstract patterns of development.

In more recent work, Wilber (2003d, p.118) expands on his understanding of development in the cultural quadrant. He argues that groups exhibit development along both isomorphic and paramorphic streams. Isomorphic streams are recognisably similar to the developmental streams observed in individuals and are composed of the intersections of the correlative individual streams. In contrast, paramorphic streams 'have no recognizable or obvious similarities with any individual streams or capacities' (Wilber 2003d, p.118). Paramorphic developmental streams are novel emergents that arise in group interaction, but not individually. For example, societal decision-making processes develop in ways that are quite different to individual decision-making processes; they require a group contract or consensus that is more than the simple sum of individual decisions. In addition, constraints in the social quadrant, such as uneven access to education, economic resources or forms of political expression, can prevent the cultural expression of individual values, so that simple aggregation of individual values to identify the cultural worldview is not feasible.

It is evident from the above discussion that cultural development is substantially more complex than individual psychological development. Culture is the product of many different streams and waves that cannot simply be reduced to the interactions of the individuals that are members of the culture. Some of the developmental streams in the cultural quadrant include 'interpretive understandings, cultural meanings in general, collective and group identities, intersubjective moral and ethical understanding, and so on' (Wilber 2000c, p.197). I would add discourses and worldviews to this list. While none of these streams is dominant, cultural groups do exhibit 'something like a center of gravity that expresses the sum total of their overall inclinations in all levels and lines' (Wilber 2003d, p.108). There is a high probability that a group will behave as if driven by this centre of gravity, particularly when the centre of gravity is embedded in educational, governmental and other institutional systems (Wilber 2003d). Wilber (2003d, p.129) argues that the dominant mode of techno-economic production is the single strongest determinant of this average level of consciousness, or cultural centre of gravity.

In *The Ever-Present Origin*, Jean Gebser ([1949] 1985) explored the development of these cultural centres of gravity through a cultural-historical analysis of what he called the 'mutations of consciousness'. Gebser identified and described a developmental progression through archaic, magic, mythical, mental and integral structures of human consciousness. These structures of human consciousness are analogous to shared cultural worldviews. Habermas' (1979) overview of sociocultural evolution in *Communication and the Evolution of Society* covers similar territory, focusing on the historical development of both concrete social institutions and cultural worldviews. Wilber (2000c, pp.158-209) draws on Gebser, Habermas, and his own work, to identify archaic, magic, mythic, rational and integral worldviews that have emerged over the course of human history. Inglehart's (2000) work on materialist and postmaterialist value structures is another example of developmental work in the cultural quadrant.

I will outline some of the characteristics of these cultural structures or worldviews, and the way that they have unfolded over time, in Chapter 7. Here, I will only note that each successive worldview in the developmental progressions mentioned above emerged in response to inherent limitations in the previous worldview, each is more inclusive than the previous, and each is more adequate in terms of its ability to solve emergent problems. Consequently, the historical evidence does not support the postmodern assertion that all cultural perspectives are equally valid.

2.4 The implications of integral theory for investigation of sustainable futures

Having outlined the central tenets of integral theory in Sections 2.2 and 2.3, I now turn to the theoretical and methodological implications for investigation of sustainable futures. Integral theory sharpens some of the criticisms of mainstream approaches to sustainable development that I first raised in Chapter 1. At the same time, it provides a theoretical and methodological framework for addressing many of these criticisms. In this section, I outline the elements of an integral approach to sustainable futures. In subsequent chapters, I will test the practical value of this approach using a case study on Australia's energy and climate policy.

2.4.1 The dimensions of sustainable development

In Section 1.4.5, I drew attention to the absence of a coherent theory identifying the important dimensions of sustainable development. Integral theory can address this absence. Specifically, integral theorists argue that any comprehensive or holistic approach must consider all quadrants. From an integral perspective, sustainable development has at least four broad dimensions:

behavioural, systemic, psychological and cultural. However, adding to the complexity, there are multiple developmental lines within each quadrant. Sustainable development at the level of human civilisation is a complex amalgam of development along these many lines. Consequently, from an integral perspective, sustainable development has four primary dimensions and many dozens of secondary dimensions.

How does this integral understanding of sustainable development relate to the popular **three pillars** understanding of sustainable development? According to integral theory, the economic and ecological pillars of sustainable development correspond to two developmental lines within the systemic quadrant. Economics examines the behaviour of collective economic systems; ecology examines the behaviour of ecosystems. Both are system sciences that adopt an objective or exterior perspective to examine collective holons (Wilber 2001, p.50). Thus, two of the three pillars of sustainable development are reduced to developmental lines within one of the quadrants – secondary dimensions under the primary dimension of systemic sustainability.

It is more difficult to locate the third pillar – the social dimension of sustainable development – on the integral map, as this dimension has very different meanings to different practitioners. In Wilber's terminology, social refers to the lower-right quadrant. Most of the conceptual approaches to sustainable development reviewed in Section 1.4 treat social systems objectively, focusing on quantitative indicators of social equity, on concrete changes to social and institutional systems, on education to achieve collective behavioural change, and on satisfaction of human needs (which are assumed homogeneous). These approaches, concerned with the exterior structure of social systems, are appropriately located in the systemic quadrant. Consequently, many conceptual approaches to sustainable development are only concerned with the integration of developmental lines within the systemic quadrant. They leave the more difficult task of integration across the quadrants unconsidered.

However, as discussed in Section 1.4.2, the social dimension of sustainable development can be interpreted more broadly, using methods that consider values, subjectivity, psychology and behaviour. For practitioners employing these methods, the social pillar offers a possible vehicle for inserting their interpretations into mainstream sustainable development discourse. Although interpretations of sustainable development from the perspective of the behavioural, psychological and cultural quadrants have so far had little influence on mainstream understanding, these interpretations do exist and can be drawn on for an integral approach.

From an integral perspective, then, most approaches to sustainable development ignore much of the important conceptual territory by focusing on developmental lines within the systemic quadrant. Some practitioners consider sustainable development from one or more of the other three quadrants, but few consider all the quadrants. A reformulation of the dimensions of sustainable development to match the quadrants of integral theory may help to draw attention to the subjective aspects of development that are currently neglected in mainstream approaches. In this thesis, I will test the practical value of a conceptual approach that recognises behavioural, systemic, psychological and cultural dimensions of sustainable development. This conceptual expansion of the dimensions of sustainable development has important methodological implications, which I will examine in the next section.

2.4.2 Revealing the four dimensions

Given that sustainable development has the four primary dimensions discussed above, it is clear that the system sciences alone are inadequate to reveal the conceptual territory that is relevant to sustainable development. These sciences, including economics, ecology and much of the work in sociology, focus on the systemic quadrant. Other methods are needed to examine behaviour, psychology and culture. In recent work, Wilber (2003a; 2003b; 2003c; 2003d) provides guidance on an appropriate suite of methods, advocating an approach called **integral methodological pluralism**.

As noted in Section 2.2.4, the quadrants are not just arbitrary theoretical constructs. Rather, they represent four epistemic communities with structurally distinct practices, paradigms and methodologies. The objective of integral methodological pluralism (IMP) is to weave together these distinct methodological practices in a way that captures all of their important insights into the nature of reality. The starting point for IMP is identification of the historically significant methodological categories associated with each quadrant. Wilber (2003a, Part IV, p.1; 2003c, Introduction, p.1) argues that most historically important methods adopt one of eight perspectives – two for each quadrant. The eight perspectives are distinguished according to the quadrant on which they focus, and whether they investigate holons in that quadrant from the **inside** or **outside**, or from first-person or third-person perspectives. A practitioner that investigates a holon from the inside attempts to become a part of that holon, either literally or metaphorically. A practitioner that investigates a holon from the outside retains a critical detachment from the holon they are studying.

These eight possible perspectives give rise to eight corresponding methodological categories, as shown in Figure 2.3. Methods from the categories inside the circles in Figure 2.3 attempt to understand holons from the inside; methods from the categories outside the circles attempt to understand holons from the outside. Thus, empiricism studies the behaviour of individual holons from the outside, whereas autopoiesis studies the behaviour of individual holons by adopting a perspective within the holon. In both cases, the methods objectively examine behaviour. That is, the adoption of a perspective within the holon is not an attempt to interpret the holon's subjective values or feelings, but to understand the objective reality experienced by the holon. Similarly, systems theory studies the behaviour of collective holons from the outside, whereas social autopoiesis is an attempt to understand the behaviour of systems by adopting a perspective within the system.

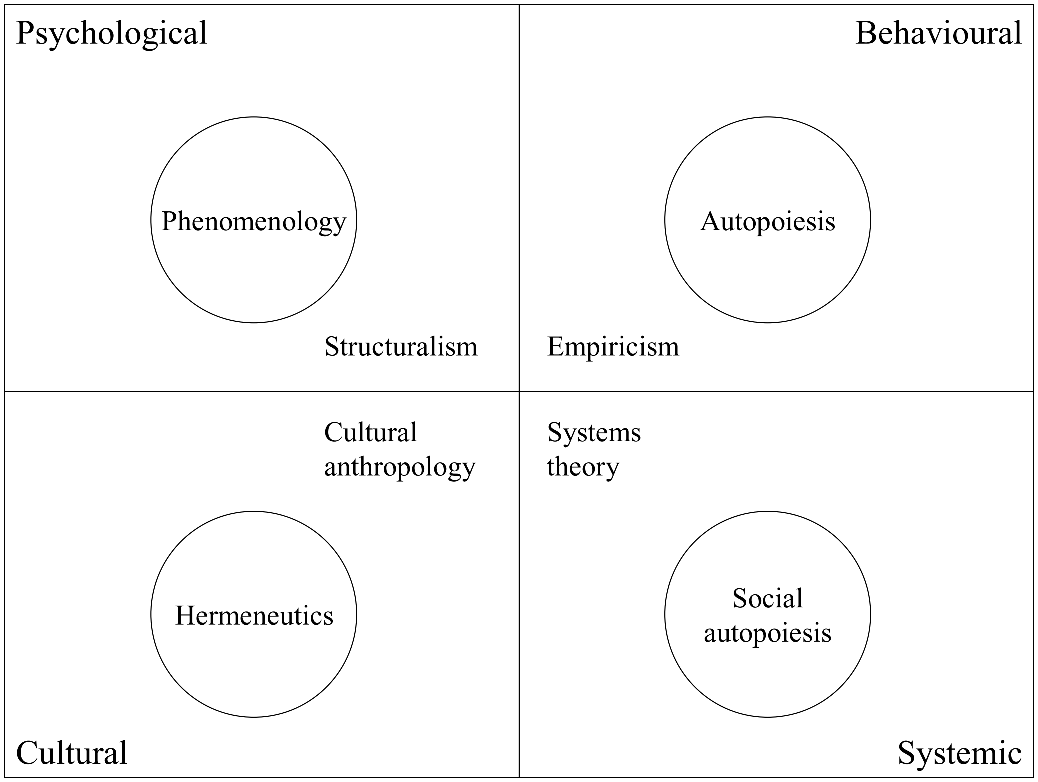

Figure 2.3: The eight methodological groups of integral methodological pluralism.
Source: Wilber (2003c, Introduction, p.1).

In the psychological quadrant, structuralism attempts to interpret the subjective interior of an individual holon from outside that holon, whereas phenomenology draws on personal subjective experience. The only individual holon that a researcher can access from the inside is their own – phenomenology draws attention to the personal experiences of the researcher. In the cultural quadrant, cultural anthropology attempts to interpret the shared meanings of groups from the outside, whereas hermeneutics attempts to interpret the shared meaning of a group by becoming part of that group.

Integral methodological pluralism implies the adoption of methods from each of the eight categories to comprehensively reveal the important aspects of each quadrant. That is, to fully understand the four dimensions of sustainable development, methods from each of these categories are required. Clearly, mastery of methods from each of these categories would place an enormous burden on any individual practitioner, so IMP points towards collaborative, interdisciplinary approaches to sustainable development. In Section 2.5, I will return to these methodological groupings and discuss the specific methods that I will employ in this thesis in more detail.

2.4.3 Balancing the four dimensions

In Section 1.4.5, in addition to noting the absence of a coherent theory of the dimensions of sustainable development, I discussed the problem of balance or integration. Resolution of conflict between the three pillars of sustainable development, or between different principles or conditions for sustainable development, is difficult. The conceptual expansion and clarification of the dimensions of sustainable development discussed in Section 2.4.1 does little to solve this problem; if anything, it makes the task more difficult by broadening the dimensions that need to be balanced.

Fortunately, integral theory provides guidance on how to balance the dimensions of sustainable development, and the various theories and methods used to explore sustainable development. As part of an integral methodological pluralism, Wilber (2003b) outlines 'meta-paradigmatic practices' for weaving together the different paradigms associated with each of the quadrants. The essence of these practices is the assertion that: 'Everybody is right' (Wilber 2003b, Part I). That is, the paradigms developed over time by different epistemic communities are all valid and should be included in any integral approach. Of course, simply asserting that everybody is right does not really resolve the inevitable conflicts between different perspectives, so Wilber (2003b, Part II) discusses three principles that provide practical guidance for integrating different theories, methods and perspectives. I will outline each of these below.

Nonexclusion

The principle of **nonexclusion** seeks to include as many perspectives as possible by establishing boundaries within which different perspectives are valid. Recall the eight methodological categories discussed in Section 2.4.2. The essence of the principle of nonexclusion is that knowledge revealed by each of these categories is valid as long as it is generated using practices that are accepted within the relevant epistemic community and refers only to the holons and perspectives associated with that category (Wilber 2003b, Part II).

There are two important points here. First, a researcher must master the practices of the field they are making claims about, and must subject those claims to review by other researchers in the field. Second, a researcher adopting a method that examines, for example, the exterior of social holons cannot make valid claims about the subjective interior of those social holons unless they also adopt a method that reveals those subjective interiors. For example, a physicist who has not mastered meditative practice may be very qualified to discuss the atomic structure of the universe, but not at all qualified to discuss those aspects of reality that are disclosed through meditation. Wilber (2003b, Part II) argues that the principle of nonexclusion 'frees a paradigm by limiting it' as the claims of that paradigm become even more believable as long as those claims are confined to the appropriate domain.

Unfoldment

The principle of nonexclusion, in itself, is not enough to resolve all conflicts between different theories, methods and practices. The principle of **unfoldment** provides further assistance. It suggests 'that all paradigms…are in themselves true and adequate; but some paradigms can be more encompassing, more inclusive, more holistic than others' (Wilber 2003b, Part II). This principle introduces a temporal, developmental element. A theory or practice that was adequate at a particular time may not be adequate as time flows on and more knowledge is revealed. That is, a paradigm can be true but partial. New paradigms continually arise that 'transcend and include' previous paradigms. This does not mean that previous paradigms were wrong; they were as true as they could be at that stage of unfoldment (or development). The principle of unfoldment focuses attention on the genealogy of ideas, paradigms and theories.

Enactment

The third principle, **enactment**, captures the postmodern realisation that 'phenomena are enacted, brought forth, disclosed, and illumined by a series of behaviours of a perceiving subject' (Wilber 2003b, Part II). There is no given world waiting to be discovered. Instead, the world is enacted, or socially constructed. The implication is that 'the phenomena brought forth by various types of human inquiry will be different depending on the quadrants, levels, lines, states, and types of the subject bringing forth the phenomenon' (Wilber 2003b, Part II).[16] In practice, this means that the world looks different to different researchers applying different practices. A researcher applying formal operational cognition to an ecological problem in the systemic quadrant will not perceive the world in the same way as a researcher applying vision-logic to the same problem. Neither is wrong, but the levels from which each is operating must be taken into account when seeking to integrate the knowledge they generate.

In later chapters of this thesis, I will use the three principles of IMP as a guide when attempting to integrate different theories, methods and practices applied to sustainable development and the specific case of Australian energy and climate policy.

[16] I have already discussed quadrants (Section 2.2.4), developmental levels (Section 2.3.1) and developmental lines (Section 2.3.1). Integral theory also includes states and types. *States* of consciousness are temporary experiences, including waking, dreaming and deep sleep, but also non-ordinary or altered states, such as peak experiences and meditative states. States can provide a temporary experience of a different developmental level. *Types* are different personality types or gender styles that will experience a particular developmental level somewhat differently. For example, male postmodern values may be slightly different to female postmodern values.

2.4.4 Subjectivity and sustainable development

In Chapter 1, I noted that mainstream conceptual approaches to sustainable development give insufficient attention to subjectivity and the social construction of reality. Using the framework provided by integral theory, I can now interpret this as a failure to adequately integrate the psychological and cultural quadrants into the theory and practice of sustainable development. According to Wilber, this failure is not unique to sustainable development discourse. Rather, he argues that a defining characteristic of modernity is the dominance of the objective quadrants and the marginalisation of the subjective quadrants (Wilber 2000c, pp.419-477). In Chapter 7, I will explore the details of Wilber's argument, focusing particularly on the history of environmental discourse. Here, I will summarise some key points for further discussion that have implications for sustainable development.

Wilber (2000c, pp.384-392) links the emergence of modernity to the widespread flowering of rational thought, or formal operational cognition, that coincided with the European Renaissance, Enlightenment and Scientific Revolution. Formal operational cognition, as noted in Section 2.3.5, provides the ability to reflect on one's own thoughts. With the widespread emergence of formal operational cognition, for the first time in human history, the realm of mind and culture (the noosphere) was fully differentiated from the realm of body and nature (the biosphere) (Wilber 2000c, pp.183-186). The differentiation of mind from body, or culture from nature, was also the differentiation of the thinking subject from the object of thought. Thus, formal operational cognition opens up the subjective realms of mind and culture, the psychological and cultural quadrants, for investigation.

Historically, the emergence of modernity marked the first widespread differentiation, in the West, of the four realms mapped by the quadrants of integral theory (Wilber 2000c, pp.401-402). Before the Enlightenment, these four realms were fused in a dominant mythic and religious worldview (Wilber 2000c, p.401). Scientific discoveries (in the objective quadrants) that contradicted the religious orthodoxy were considered heresy and severely punished. Artists (working from the intentional quadrant) were forced to depict religious themes, consistent with the moral doctrines of the church (the cultural quadrant). The Enlightenment set each realm free from the others for the first time (Wilber 2000c, p.401). Science was free to pursue the rational scientific method unfettered by religious doctrine, art travelled off in new directions unrelated to religious themes and morality became something that could exist independent of religious beliefs (Wilber 2000c, pp.425-426). This new freedom, this differentiation of the quadrants, is one of the enduring contributions of formal operational cognition.

However, while formal operational cognition differentiated the quadrants, it was not able to integrate them (Wilber 2000c, pp.401-403). The differentiation slid into an unhealthy dissociation in which practitioners in each of the quadrants, and particularly practitioners of objective and subjective methods, pursued their own methods in isolation (Wilber 2000c, p.426). Worse, the power of instrumental rationality in the objective quadrants was such that it came to dominate the human approach to the world. The dissociation of the quadrants 'allowed the sweeping advances of the natural sciences (the it-domain) to overwhelm the interior, subjective, moral, and cultural domains (I and we)' (Wilber 2000c, p.426). The West came to focus almost entirely on the objective reality revealed by rational scientific methods, and to either ignore subjective reality, or reduce it to its objective correlates. Wilber (2000c, pp.419-77) calls the resulting world '**flatland**' – a world of surfaces, without any depth or meaning.

The inadequate attention to subjectivity that I have observed in many conceptual approaches to sustainable development is entirely consistent with Wilber's thesis that the Western world is still caught in flatland. In Chapter 7, I will describe two very different historical paths to flatland that are reflected in different environmental discourses. Here, it is sufficient to note that the marginalisation of the subjective quadrants is not just a failure to integrate objective and subjective methods; it is also a denial of personal and cultural development. Wilber's proposed path beyond flatland requires greater attention to the insights of psychology and meditative practice (the psychological quadrant), postmodernism (the cultural quadrant) and developmental theory. It requires an all quadrant, all level (AQAL) approach (Wilber 2001, pp.66-73).[17] I will examine the implications of this proposed solution for sustainable development in detail in later chapters. In the next section, I will briefly discuss some of the implications for sustainable development of considering all of the levels revealed by developmental theory.

2.4.5 The contribution of developmental theory

An important contribution of integral theory to sustainable development discourse is the introduction of a coherent theory of development as a process of transcendence and inclusion. The integral theory of development is similar to that underpinning evolutionary systems theory but goes further by adding a theory of subjective development and introducing the concepts of developmental levels and lines, or waves and streams. The main implication of evolutionary systems theory for sustainable development, as outlined in Section 1.4.3, is that human civilisation is reliant on ecological systems for survival. An additional implication contributed by integral theory is that all developmental levels and lines must be included or considered in any comprehensive approach to sustainable development.

The integral theory of development has several important implications for conceptual approaches to sustainable development. First, all people must start their personal development from the earliest developmental waves in each stream (e.g. from a preconventional wave of moral development and

[17] The acronym **AQAL** is actually shorthand for 'all-quadrants, all-levels, all-lines, all-states, all-types' (Wilber 2002). See the previous footnote for a definition of states and types. I will focus on quadrants, levels and lines in this thesis.

the archaic wave in values development). This means that, at any point in time, human society includes people expressing all waves of development, with very different values and worldviews (Wilber 2001, p.56). An integral approach to sustainable development must recognise this and find ways to consider, include and care for all developmental waves, even those waves that do not value inclusiveness. Wilber (2003b, Part I) argues that integral policies must allow people at all waves of development 'to freely explore [their] own potentials but in ways that those waves would not construct if left to their own exclusionary practices'. I will propose suitable policies, in the context of climate change response and sustainable development, in Chapters 8 and 9.

Second, integral theorists argue that ecological awareness only emerges with particular developmental waves. Cognitively, the systems thinking required to fully grasp the dependence of human social systems on ecological systems only emerges as formal operational cognition begins to give way to postformal cognition, or vision-logic (Wilber 2000b, pp.201-202). Further, it is only with the emergence of worldcentric morality and postmodern values that an individual begins to care about ecological problems other than those that personally impact them or their immediate group (Wilber 2000c, p.541). Global environmental problems, like climate change, become a moral problem for those exhibiting worldcentric morality (Wilber 2000b, p.137). Similarly, only postconventional morality can step outside current societal norms and critique the way society is organised and the associated ecological impacts.

A crucial implication for sustainable development is that many ecological and social problems, particularly global problems, only become evident after a lengthy process of personal development. Achieving greater awareness of these problems, and a commitment to pursue solutions, is not a simple matter of providing information and education. Rather, ways must be found to help people healthily progress through the waves of personal development so that the cultural centre of gravity gradually shifts towards ecological awareness. This will require a reorientation of many aspects of modern (and postmodern) society. Hence, Wilber (2001, pp.83-107) calls for an integral politics, integral governance, integral medicine, integral business, integral education, integral psychology and integral ecology. All of these are necessary for sustainable development.

An additional implication is that the rhetorical embrace of sustainable development by an individual or group does not always indicate the presence of ecological awareness. Rather, individuals and groups will interpret sustainable development from whatever developmental wave they are activating. For example, I would argue that interpretations of sustainable development that strongly emphasise economic growth and deny ecological limits are applying formal operational cognition and rational values. None of these interpretations is wrong, although some may be less inclusive. Policies that facilitate personal development will also promote greater inclusion, as development is a process of transcendence and inclusion.

Finally, integral theory points out that the noosphere, the realm of human culture, is a genuinely higher stage of development than the biosphere. Although the differentiation of the noosphere from the biosphere has slid into dissociation (Wilber 2000c, p.192), creating very evident ecological problems, the solution is not to revert to the biosphere, or "return to nature". Rather, humans must learn how to achieve 'mutual understanding and mutual agreement in the noosphere' on the best way to collectively proceed (Wilber 2000a, p.285). That is, we must learn how to harness the new abilities of the noosphere to collectively articulate a shared vision for a sustainable human civilisation. Compliance with the rules of the biosphere is part of the solution, but the remainder of the solution will be a new development in the subjective realm of the noosphere. I will propose some policies for sustainable development that are consistent with this conclusion in Chapters 8 and 9.

2.5 Research methods in this thesis

In this section, I will briefly consider the implications of integral theory for methodological practice and discuss my specific research methods. My primary methods are integrative or meta-paradigmatic, drawing on IMP, however I also employ methods associated with particular quadrants as required.

2.5.1 Implications of integral methodological pluralism

In this thesis, I adopt integral epistemology and use integral methodological pluralism as my guiding theoretical perspective. The approach I have taken is consistent with current priorities for the development of integral studies as a field of enquiry. Integral theory has been developed in substantial detail. However, the applications of integral theory in diverse fields are only just starting to emerge. I believe that the first task for these emerging applications of integral theory is to identify relevant material from each of the quadrants that needs to be included in an integral approach. That is, the first task is to identify work that has *already been done* using methods from each of the eight categories of IMP (outlined in Section 2.4.2). I attempt this task for energy and climate change in Chapters 3, 4 and 5. The primary method is review and synthesis of literature and policy practices, guided by the integral map.

The second task is to use the literature and policy reviews to identify research gaps that need to be addressed across the quadrants. I have not attempted to master methods from all of the eight methodological categories of IMP, as I believe that specialisation remains important to provide detailed knowledge of particular fields. Given that I am not an expert in all eight methodological categories, the research gaps I identify are at least partly driven by my particular methodological skills and interests. Another researcher, with different skills, would undoubtedly choose other topics. My particular emphasis is on policies and practices that will help to promote a sustainable and desirable human civilisation. Implementation and development of such policies and practices requires collective effort. Consequently, I tend to employ methods associated with the collective quadrants in this thesis, rather than those associated with the individual quadrants. In Chapters 5, 6 and 7, I address systemic and cultural research gaps identified in Chapters 3 and 4. The specific research methods I use are described in Sections 2.5.2, 2.5.3, 2.5.4 and 2.5.5.

The third task for emerging applications of integral theory is to attempt integration of existing work. I undertake this task in Chapters 7, 8 and 9. The task of integration is guided by the three principles of IMP discussed in Section 2.4.3. These principles embody meta-paradigmatic practices that are themselves integrative research methods. These integrative research methods do not generate new knowledge within any one quadrant. Instead, they generate new knowledge and insights by identifying patterns, relationships and consistencies across the quadrants. These integrative methods are my primary research methods in this thesis. The application of integrative research methods relies on existing work by researchers working in the epistemic communities associated with each quadrant. Therefore, while I do not seek to *master* methods from each of the eight methodological categories identified by Wilber, I do seek to *understand* them so that I can assess the validity of existing work against what is deemed acceptable by the relevant epistemic community.

The next four sections summarise my understanding of the major methodological groups in each quadrant and identify the specific methods that I employ within each quadrant, in addition to the integrative research methods already described in Section 2.4.3. Given Wilber's argument that subjective approaches are currently marginalised in Western society, I devote more space to discussion of subjective methods than objective methods, in the belief that many readers will be less familiar with these methods.

2.5.2 Behavioural methods

In Figure 2.3, the two methodological categories associated with the behavioural quadrant are empiricism and autopoiesis (Wilber 2003c, Introduction, p.1). Both consider the exterior of an individual holon (an 'it' or third-person), however empiricism adopts a third-person or outside perspective on the holon, whereas autopoiesis adopts a first-person or inside perspective on the holon (Wilber 2003d, Part I).

Empiricism

Empirical methods are objective methods that assume a pre-given world and use direct sensory experience to discover knowledge about that world. In essence, empiricism involves looking at the world and describing the behaviour of the objects observed – individual holons. Behaviourism, a method in psychology that focuses on observable and measurable data, is one form of empiricism; positivism, the classical scientific method that focuses on the data of experience as the basis for theory, is another (Wilber 2003a, Part V).

Sciences that tend to take an empirical approach 'include most of the natural sciences focusing on individual behaviors, such as physics, chemistry, molecular biology, biochemistry, evolutionary behaviorism/psychology, neurophysiology, neuroscience, and cognitive science' (Wilber 2003a, Part V). Although I draw on personal observation to support some aspects of my research, I do not employ empirical methods to any great extent in this thesis. Instead, I draw on empirical work by other researchers, including measurements of trends in energy consumption and greenhouse gas emissions, observations of human behaviours and activities that consume energy, and theoretical work on the evolutionary motivations for activities that consume energy.

Autopoiesis

Autopoietic theory is a body of work developed by the Chilean biologists Humberto Maturana and Francisco Varela (e.g. Maturana & Varela 1980; Maturana & Varela 1987). Autopoiesis literally means self-creation. From the perspective of the behavioural quadrant, it is the process by which an individual holon (such as a cell or organism) produces its own organisation and maintains and constitutes itself in a space. That is, autopoiesis is a theory of self-regulation.

To develop this theory, Maturana and Varela adopted a perspective within the organism of interest. Thus, Wilber (2003c, Introduction, p.1) defines autopoiesis as a method that explores self-regulating behaviour by adopting a perspective within the organism, or within any individual holon. According to Wilber (2003c, Introduction, p.1), autopoietic methods:

> …try to explain, *from the inside view of the organism*, the types of reactions, behaviors, and cognitions that the organism itself makes as it encounters, enacts, and brings forth its world. This is also sometimes called **biological phenomenology**, because it attempts to describe the phenomenal world of the organism itself.

I have not attempted to apply autopoietic methods in this thesis, as this is not my area of expertise. However, I do look for autopoietic approaches in my review of climate change literature, in Chapter 3.

2.5.3 Systemic methods

In Figure 2.3, the two methodological categories associated with the social or systemic quadrant are systems theory and social autopoiesis (Wilber 2003c, Introduction, p.1). Both consider the exterior of collective holons (third-person plural 'its'), however, systems theory adopts a third-person or outside perspective on collective holons, whereas social autopoiesis adopts a first-person or inside perspective on collective holons (Wilber 2003d, Part I).

Systems theory

Systems theory is a general term for a diverse body of theory and method characterised by an ontological assumption that reality is composed of interrelated systems and an epistemological commitment to methods that investigate the dynamics of systems without reducing them to their component parts. A systems perspective draws attention to system inputs and outputs, creative emergence, system evolution, feedback, and other aspects of system dynamics. There are many variants on the basic systems approach. The common element is the adoption of an objective perspective to examine collective holons (i.e. systems) from the outside.

One basis for methodological variation is the choice of system to analyse. The system of interest may be a technological infrastructure system, an economic system or market, an ecosystem, a social system or an institutional system of laws, regulations and customs, to give a few examples. Each type of system tends to attract different methodological approaches, leading to the formation of different disciplines based on the choice of system to analyse. Thus, economics analyses economic systems and markets, ecology analyses ecosystems and sociology analyses social systems. Each of these disciplines attempts to discern the dynamic behaviour of systems and relationships within and between systems, or how systems function and fit together.

Systems methods also differ in their analytical sophistication. At their most basic, systems methods simply observe and record the behaviour of collective holons. More sophisticated applications use computer modelling as an investigative tool to explore the dynamic behaviour of systems. One of the most sophisticated versions of systems theory, emerging only in the latter half of the 20th century, is typically referred to as complex systems theory or evolutionary systems theory:

> Complex systems thinking follows in the tradition of von Bertalanffy's general systems theory, and draws upon other concepts from the new science emerging over the past three decades, for example, catastrophe theory, chaos and complexity theory, non-equilibrium thermodynamics and self-organization, and Jaynesian information theory (Kay et al 1999, p.722).

Cognitively, complex systems theory is postformal and post-rational. It moves beyond linear notions of cause and effect to explore non-linear chaotic behaviour and creative emergence.

Systems methods are valuable for revealing the complex web of relationships between holons from an objective perspective, including the reliance of human social systems on healthy ecological systems. A systems perspective informs much of the work on sustainable development reviewed in Chapter 1. As will become clear in Chapters 3 and 4, a systems perspective also informs much of the literature on climate change response. However, I do not rely solely on review of systems work in this thesis – I also employ some systems methods myself, primarily in Chapters 3, 5, 6 and 8.

In Chapter 3, I draw on the systems framework described by Robèrt et al (2002) to guide a review of the sustainability of the Australian energy supply system and its potential impact on climatic systems and ecological systems. I outlined this framework in Section 1.4.3. I will return to this framework at various points through the thesis, particularly in Chapter 8 where I draw on some of the process principles described by Robèrt et al (2002).

One of the process principles identified by Robèrt et al (2002) is backcasting. Backcasting is a normative futures method that investigates pathways to, and consequences of, desirable futures (Dreborg 1996; Robinson 2003). Backcasting does not attempt to predict the future; instead, it defines a desirable future as a goal and identifies ways of achieving that goal. Backcasting draws on systems theory to investigate the dynamics of technological, economic, social and institutional systems over the period of interest. While backcasting is not one of my main methods in this thesis, there are elements of backcasting in the policy proposals I develop in Chapter 8. I draw particularly on the work of John Robinson, who introduced the term **backcasting** in a 1982 paper (Robinson 1982) and has since developed a 'second generation backcasting' with a greater emphasis on citizen participation (Robinson 2003). I will return to Robinson's work in Chapter 8.

In Chapter 5, I draw partly on an objective, third-person perspective to review Australian energy and greenhouse policy. This perspective is useful for identifying policy content, the practices used to develop policy and policy outcomes. It provides a framework for reviewing policy tools in the terms accepted by objective epistemic communities.

In Chapter 6, I focus on the economic system and use economic theories and methods to estimate the magnitude of energy and transport subsidies in Australia. Economics, although not always perceived in these terms, is a system science. Economists understand the economy as a system, with sectoral subsystems, market supply and demand subsystems, and even economic actors that behave as utility-maximising subsystems. In Chapter 6, I use a specific economic definition of an energy subsidy to guide a search through budget papers, government documents and other available material to identify and catalogue subsidies. While this application of systems theory is not particularly sophisticated, and requires little economic modelling, it is appropriately associated with the systemic quadrant owing to its objective focus on economic systems.

Chapter 8 considers all quadrants, however, it gives particular attention to the objective form of institutional systems for policy development in Australia's energy sector, and how these might be altered to promote an integral approach to sustainable development. In Chapter 8, I use critical review and analysis of existing social and institutional systems to inform design of new social and institutional systems. I also use evolutionary systems theory as the foundation for an adaptive and evolutionary approach to policy, characterised by social learning. Further, I consider the objective form of social practices required to support individual participation in deliberative policy development.

Social autopoiesis

I have already described autopoiesis in Section 2.5.2. Social autopoiesis extends the approach pioneered by Maturana and Varela to social systems, or collective holons. Niklas Luhmann proposed the sociological application of autopoiesis in his book *Social Systems* (Luhmann [1984] 1995). Luhmann ([1984] 1995, p.13) defines social systems as self-referential systems of communication, characterised by the ability to differentiate relations with themselves from relations with their environment. Social systems maintain an identity distinct from their complex environment by filtering out external information that is not meaningful (Bausch 2001; Luhmann

[1984] 1995). Like autopoiesis in the behavioural quadrant, social autopoiesis requires the researcher to adopt a position inside the social system to understand how social systems make their selections from the complexity of the uncertain outside environment (Bausch 2001; Wilber 2003c, Introduction, p.1).

I have not attempted to apply social autopoietic methods in this thesis because, as noted already in Section 2.5.2, autopoiesis is not my area of expertise. However, I do look for applications of social autopoietic theory to energy policy and climate change response in my literature review in Chapter 3.

2.5.4 Psychological methods

In Figure 2.3, the two methodological categories associated with the psychological quadrant are structuralism and phenomenology (Wilber 2003c, Introduction, p.1). Both interpret the interior of an individual holon (a first-person 'I'), however, structuralism develops its interpretations from a third-person perspective outside the holon, whereas phenomenology draws on first-person experience from inside the holon (Wilber 2003d, Part I).

Structuralism

Referring to the psychological quadrant, structuralism is a label for a group of methods that attempt to discern structures or stages in psychological development.[18] I introduced these methods in Section 2.3.5, where I discussed structural developmental theory, and its argument that learning and development takes place by building more adequate structures on existing structures. Structural developmental theory is the foundation of structuralism in the psychological quadrant. As I noted in Section 2.3.5, Piaget pioneered structural developmental theory through his experimental work with children. Piaget's methods, since adopted and elaborated by numerous developmental psychologists, involved semi-structured interviews to draw out a person's reasoning and values and identify the conceptual structures through which they understand and act upon the world (Kahn 1999, p.77). Structural methods are a type of psychoanalytic inquiry (Wilber 2003a, Part IV, p.1). As noted by Wilber (2003c, Introduction, p.1), structural methods seek to interpret subjective interiors from outside those interiors. That is, the researcher is not interpreting their own interior, but trying to understand the interior of another person by asking them questions.

Wilber (2003d, pp.54-56) identifies four steps in the application of structuralism. The first is to pose a dilemma to a group and classify the responses that arise. The second is to check and see if those classes are genuine developmental stages by using longitudinal studies to track changes in the responses of the individuals in the group over time. The third is to perform cross-group or cross-cultural studies to see how widespread (local or universal) the stages are. The fourth is to define the actual structure of each stage.

[18] Structuralism can also be applied in the cultural quadrant. I will discuss this application in Section 2.5.5.

Kahn (1999, p.77-93) describes a typical structural method and provides advice on constructing the interview, enlisting participants, interviewing, generating a coding manual, coding the interview data, establishing the reliability of a coding system and data analysis. Kahn also gives examples of interview questions and coding manuals from his empirical work. Kahn's work is an excellent starting point for anyone seeking to apply structural developmental methods.

I do not apply structural developmental methods directly in this research. Instead, I draw on the structural work of other researchers (e.g. Beck & Cowan 1996; Kahn 1999; Kegan 1982, 1994; Kohlberg 1984; Maslow [1954] 1987; Max-Neef 1991; Piaget [1929] 1973; Wilber 2000b) to understand the psychological structures through which people construct their understanding of energy use, climate change and other sustainable development issues. These researchers focus on structures in different developmental lines, including cognition, needs, values, morality and identity. I use their work to understand how different people might interpret reality, and how these different interpretations influence sustainable development policy and practice. This, in itself, requires interpretation on my part, as few of the researchers listed above focus specifically on energy use or climate change. My interpretations are informed by my own observations and informal conversations with people about energy use and climate change.

Phenomenology

Phenomenology is a philosophical school of inquiry that is concerned with the felt nature of sensory experience, or the way humans actually perceive the world in the first instance. According to Brown and Toadvine (2003, p.xi), the rallying cry of phenomenology is: 'To the things themselves!' This is a call to examine how things actually appear in individual experience, before the addition of abstract systems of meaning that categorise and objectify that experience (Brown & Toadvine 2003). In other words, phenomenology attempts to interpret subjective experiences from the inside of an individual holon – the self.

To apply phenomenology, I must attend to my own experiences as they arise. How do I perceive nature? What do sustainable or unsustainable practices feel like while I am enacting them? How do I experience a problem like climate change? Phenomenology requires introspection, reflection and meditation to generate self-knowledge. My own self-knowledge informs my research in conscious and unconscious ways. For example, I am aware that the way I understand environmental problems has changed over time, and that the change feels like a developmental progression towards greater wisdom. I am attracted to developmental theories of learning because they reflect my own experience. My decision to explore the application of developmental theories to environmental problems in my research is driven in part by my phenomenological experience.

Phenomenology includes the kind of introspection and reflection on personal values that I undertook in Section 1.3.2. By understanding our own values, we can begin to understand how they might influence our research, and what this means for its wider validity. Reflection is also a way of developing deeper insights into a problem. As Blackburn (1999, pp.10-11) puts it:

> …reflection is continuous with practice, and our practice can go worse or better according to the value of our reflections…Reflection enables us to step back, to see our perspective on a situation as perhaps distorted or blind, at the very least to see if there is argument for preferring our ways, or whether it is just subjective.

I use reflection and introspection in this thesis as a continuous methodological practice, as Blackburn suggests. This takes the form of a constant reminder both to heed my own experience, and question how that experience structures my methods and conclusions. In practical terms, I find that this process of introspection usually takes place during my daily exercise or other routines. Some of my best reflection during this research project took place on my bicycle trips between home and office.

Another aspect of phenomenology is to seek out the kind of experiences that you wish to understand. Thus, if I want to understand why people resist adoption of practices that can reduce their energy use, one useful source of knowledge is to try and reduce my own energy use. I have used "self experiments" of this kind throughout my research, and I report on the results where appropriate. This aspect of phenomenology includes attention to one's own habitual practices, and how these practices arose (Owens 2002, p.44).

Spiritual practices, such as meditation, are a type of phenomenology involving reflection on the nature of reality. A theme that is evident throughout Wilber's writing is the validity of meditative and spiritual practices as research methods for enacting realms that are not open to traditional scientific enquiry. Owens (2002, p.46) notes the value of meditative practice in his own research as a way of cultivating 'a space of silence and stillness out of which [arises] a less cluttered understanding of the problem'. I have adopted Ashtanga Yoga as a form of meditative practice during my research, although not with sufficient dedication to generate significant research insights. Rather, my practice has acted as an aid to reflection at particular times during my research.

2.5.5 Cultural methods

In Figure 2.3, the two methodological categories associated with the cultural quadrant are cultural anthropology and hermeneutics (Wilber 2003c, Introduction, p.1). Both interpret the shared interiors of collective holons (first-person plural groups), however, cultural anthropology develops its interpretations from a third-person perspective outside the group, whereas hermeneutics develops its interpretations from a first-person perspective inside a group (Wilber 2003d, Part I).

I find Wilber's use of the term 'cultural anthropology' as a label for third-person approaches to culture problematic for several reasons. First, the ethnographic methods of anthropology are only one way of approaching culture from a third-person perspective. Others, as Wilber (2003d, Part IV, p.2) points out, include archaeology, genealogy and various schools of structuralism. The label cultural anthropology fails to adequately capture this diversity. Second, cultural anthropology, as understood by its practitioners (e.g. Monaghan & Just 2000), requires not just the application of a third-person perspective, but also the development of a first-person or hermeneutic perspective.

Wilber (2003d, Part IV, p.2) coins the term 'culturology' as an alternative label for this methodological category. I prefer the label **cultural studies** as it refers to an existing field, designates a broader field of inquiry than that designated by cultural anthropology, and implies the adoption of critical distance (a third-person perspective) in order to *study* culture. I will therefore refer to the third-person perspective on culture as cultural studies throughout this thesis.

Cultural studies

Methods that adopt a third-person perspective on culture attempt to identify the interior rules and patterns (structures) that a particular group follows. In addition, consistent with the integral theory of cultural development that I introduced in Section 2.3.6, some of these methods attempt to trace how cultural structures change over time. Methods in cultural studies include archaeology, genealogy and various schools of structuralism. For Wilber (2003d, p.17), structuralism is the most influential and paradigmatic approach in cultural studies. Whereas structuralism in the psychological quadrant (see Section 2.5.4) focuses on structures in individual holons, structuralism in the cultural quadrant focuses on structures in collective holons or groups.

Structuralism, poststructuralism and adequate structuralism

It is important to clarify what Wilber (2003d) means by **structuralism** and how the structuralism he discusses relates to historical forms of structuralism and poststructuralism. Wilber's use of the term is not necessarily consistent with common understanding in cultural studies, and this can lead to confusion if not clarified. In general terms, Wilber (2003d, pp.17-18) defines structuralism as 'the study of the behaviour of an interior holon' in an attempt to disclose 'the rules and patterns [or structures] that the subholons internal to that holon are following'. These structures include any linguistic rules, discourses or worldviews that shape the way a group interprets reality. As already noted, structuralism can be used to study both individual and cultural holons. I discussed its application in the psychological quadrant in Section 2.5.4.

Historically, structuralism in the cultural quadrant has its origins in the work of the linguist de Saussure ([1916] 1974).[19] Discussing language, de Saussure argued that a word has no meaning in and of itself. Specifically, the same word may have different meanings in different contexts, and different words (from different languages) can have the same meaning. In the absence of any inherent meaning, it is the relationship between words that brings meaning. That is, 'a meaningless element becomes meaningful only by virtue of the total structure' (Wilber 2000b, p.165). It is the

[19] Although, as Wilber (2003d) points out, many of the great metaphysicians of the spiritual traditions employed a type of classical structuralism, particularly Plotinus, Nagarjuna and Shankara.

entire language and its system of grammatical rules that carries meaning, rather than any individual word.

The early structuralists built on de Saussure's insight, arguing that linguistic structures are self-regulating and that individuals 'conform to a system of social meaning embedded in language' (Crotty 1998, p.199).[20] The implication of this argument is that individuals are subordinated to the cultural context; they become puppets of a vast cultural system that speaks through them and is not apparent to them (Wilber 2003d, Part II, p.3). This recognition of the structuring role of culture would blossom into one of the enduring insights of postmodernism. However, early structuralism had two important and related limitations. First, it lacked any historical or genealogical perspective. It therefore proved unable to account for change and development. Second, it sought universal and timeless structures, and consequently marginalised authentic cultural diversity.

Poststructuralism was, in part, an attempt to address this second problem. The poststructuralists (e.g. Jacques Derrida and Michel Foucault) aggressively denied the existence of the subject, and of universal structures, arguing instead for plural cultural contexts with no grounding in any objective reality.[21] While poststructuralism was a valid attempt to give voice to plural cultural perspectives, the denial of any universal structures left no way to weave these voices together. This led to a postmodern intellectual climate where truth, meaning and knowledge were all relative, socially constructed and context dependent. In the terms of integral theory, everything was reduced to the cultural quadrant and any type of development was denied, because all perspectives were treated as equally valid (Wilber 2000c, p.xi). I have already discussed the limitations of this postmodern, poststructural intellectual climate, in Section 2.2.1.

In place of poststructuralism, Wilber (2003d, p.23) advocates **adequate structuralism**, which is 'competent structuralism as judged by the ongoing knowledge-community of those engaging the paradigm'. Adequate structuralism is not a return to early structuralism, with its evident limitations, but an attempt to build on the enduring insights of structuralism while rejecting the extremes of poststructuralism. Adequate structuralism retains an emphasis on cultural structure and context, but also recognises the role of the individual subject (including the researcher) in co-creating and interpreting reality. In addition, adequate structuralism incorporates a developmental or genealogical perspective that pays close attention to the way structures change over time. This developmental perspective allows a reintroduction of the notion of universal structures, while retaining sensitivity to the plurality introduced by diverse cultural contexts.

According to Wilber (2003d, Part II, p.3), Foucault was a key figure in the development of adequate structuralism. Foucault's neostructuralism (e.g. *The Archaeology of Knowledge*) introduced genealogy to

[20] Theorists associated with early structuralism included Claude Lévi-Strauss, Roland Barthes, Jacques Lacan and Michel Foucault.

[21] Note that Foucault is associated with both structuralism and poststructuralism (and later forms of structuralism), reflecting the development of his own thinking.

structuralism (Foucault [1969] 1989). His later work on interpretive analytics (e.g. *The History of Sexuality*) attempted an integration of hermeneutics (the interpreting subject) and neostructuralism (Foucault [1976] 1990). These developments were crucial to the emergence of adequate structuralism. Adequate structuralism seeks structures that are not rigid sets of rules, but 'holistic, dynamic pattern[s] of self-organizing processes that maintain themselves as stable configurations through their ongoing reproduction' (Wilber 2003d, p.23). These structures describe a probability that a particular cultural holon will exhibit certain kinds of behaviour and discourse (Wilber 2003d, Part II, p.2).

Causal layered analysis

Inayatullah (1998) introduces a futures method called **causal layered analysis** (CLA) that is particularly useful for revealing deep cultural meanings and structures, including discourses, worldviews, myths and metaphors. Causal layered analysis is inspired by poststructural thought, particularly the work of Foucault. In Appendix B, I provide an outline of CLA and discuss some conceptual differences between CLA and integral theory. I do not apply CLA directly in this thesis, however, I do use some of the five tools in the 'poststructural futures toolbox' outlined by Inayatullah (1998, pp.818-819).[22]

Specifically, I use **deconstruction** (alongside reconstruction) throughout this thesis to identify the hidden cultural assumptions in the way problems are defined. Deconstruction takes something that can be critiqued, such as a book or a worldview, and 'break[s] apart its components' to determine which actors, hidden assumptions and meanings are privileged (Inayatullah 1998, p.818). It breaks apart problems or questions to reveal the assumptions inherent in the way they are framed. As discussed in Section 2.2.1, a postmodern intellectual climate obsessed with deconstruction breaks reality down into a plurality of incommensurable perspectives. However, deconstruction applied with care and complemented with reconstruction (Slaughter 2002a) can contribute to an integral approach. Used in concert with adequate structuralism, deconstruction can reveal hidden worldview commitments and use these insights to construct a more adequate understanding of structures in cultural development.

I also use **genealogy** throughout this thesis to trace the way the understanding of a problem or issue has developed over time. Inayatullah (1998, p.818) defines genealogy as a 'history of paradigms'. Genealogy asks which discourses have been dominant, and how the concept of interest has travelled through those discourses. It recognises the crucial importance of historical events in determining the present and future nature of reality. For Wilber (2002, Sidebar A), genealogy reveals the development of cultural structures over time through recognisable stages.

[22] The five tools are deconstruction, genealogy, distance, alternative pasts and futures and reordering knowledge.

Discourse analysis

In addition to the tools described above, I draw particularly on discourse analysis in this thesis as a way of identifying cultural structures. A **discourse** is a type of cultural structure, also called an 'episteme' (by Foucault) or a 'cognitive worldview' (by Wilber). According to Dryzek (1997, p.8):

> A discourse is a shared way of apprehending the world. Embedded in language, it enables those who subscribe to it to interpret bits of information and put them together into coherent stories or accounts. Each discourse rests on assumptions, judgments, and contentions that provide the basic terms for analysis, debates, agreements, and disagreements.

Discourse, then, is an expression of the shared structure through which a particular cultural group understands the world. Within any society, numerous discourses exist in parallel, interacting to greater or lesser degrees. Dryzek (1997) identifies four elements that define a discourse and enable it to be distinguished from other discourses:

- Basic entities recognised or constructed
- Assumptions about natural relationships
- Agents and their motives
- Key metaphors and other rhetorical devices.

Discourse analysis uses these or other distinguishing elements to identify alternative discourses associated with a particular issue. For example, Dryzek (1997) identifies different discourses arising in response to environmental issues, whereas Thompson and Rayner (1998a) identify climate policy discourses. Discourse analysis can be defined as 'the analysis of language as it is used to enact activities, perspectives, and identities' (Gee 1999, pp.4-5). Discourse analysis examines written and oral language for what it reveals about underlying cultural structures.

In this integrative thesis, I rely primarily on discourse analyses by other authors. In Chapter 4, I review applications of discourse analysis and other cultural methods to climate change response. I do not attempt to identify new discourses, but to catalogue discourses already identified by other authors and interpret how those discourses are expressed in relation to energy consumption and climate change response. Chapter 4 relies on literature review and some interpretation.

In Chapter 7, I apply an integrative method that I call **meta-discourse analysis**. In essence, this method involves discourse analysis of discourse analyses. That is, I examine the language used by other authors to describe different discourses and search for consistencies, patterns and relationships across discourses. Specifically, I examine descriptions of cultural structures by integral theorists and descriptions of environmental discourses and climate policy discourses by political and cultural theorists. I identify consistencies in the discourse descriptions that provide a basis for integration of the different theories underlying the discourse analyses.

Hermeneutics

Hermeneutics, or collaborative inquiry, is 'the art and science of interpretation' (Wilber 2003c, Part III, p.1). The origins of hermeneutics are in biblical interpretation but it has since been applied to many other texts, including the unwritten text that is shared language (Crotty 1998). Key theorists in the history of hermeneutics include Wilhelm Dilthey, Martin Heidegger, Hans-Georg Gadamer and Paul Ricoeur (Crotty 1998; Wilber 2000c).

The application of hermeneutics requires the researcher to develop mutual understanding and solidarity with the members of the group that he or she wishes to study. It requires some type of participation in, or direct acquaintance with, the group. However, it requires more than group membership, as the researcher must also attempt to draw out the implicit contexts that structure the group's values and meanings (Wilber 2000c, p.134). Hermeneutics is a first-person mode of inquiry into first-person plural realities.

In my research, I have used a hermeneutic method called action research. Action research is:

> …a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview…It seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people and more generally the flourishing of individual persons and their communities (Reason & Bradbury 2001, p.1).

In an action research approach, the researcher is actively and explicitly involved in working with groups to create change. This action becomes part of the research process.

Over the course of my thesis research, I have worked with several groups campaigning or developing policy recommendations on energy and climate issues. These groups include the Climate Action Network Australia (CANA), the Australian Energy Group (ausenergy, an online forum), the Australian Cooperative Research Centre for Renewable Energy (ACRE) Policy Group, the Moreland Energy Foundation Limited (MEFL), the Australian Conservation Foundation (ACF) and the Utilities Consumer Advocacy Project (UCAP) Reference Group. Participation in these various groups and forums informs my understanding of the different discourses that underpin the energy and climate change debate.

I have also been involved in a series of twelve householder workshops exploring the social and cultural influences on electricity use in Australia and policy options for helping householders to manage their electricity demand (see Riedy et al 2004). Householders were recruited for the workshops using a purposive sampling strategy that sought particularly to access the views of low-income and disadvantaged householders and people with little previous experience of saving energy. Workshops combined community education objectives with a research objective of identifying preferred policy options to help householders to better manage their electricity demand. The workshop research was conducted as part of a separate project and is not part of my thesis research. However, it ran parallel to my thesis research and has unavoidably influenced and informed the conclusions I reach in my thesis. I mention it here for transparency and occasionally reference its results.

I have also sought out experiences that help me to understand different cultural discourses from an inside perspective. For example, in order to better understand the neoclassical economic worldview, I attended a workshop of the Economics and Environment Network at the Australian National University. The presentations and informal discussions at the workshop helped me to move beyond my stereotypical view of the economic perspective and begin to understand the complexity of cultural discourse. These hermeneutic methods inform my literature review in Chapter 4, my policy review in Chapter 5, my theoretical work on cultural discourse in Chapter 7, and my integral policy proposals in Chapters 8 and 9.

2.6 Conclusion

In this chapter, I have sought to address the following research questions:

- How does integral theory relate to existing conceptual approaches to sustainable futures?
- What are the theoretical and methodological implications of integral theory for sustainable futures research?

I addressed both questions particularly in Section 2.4. There, I argued for an expansion in the dimensions of sustainable development to cover the behavioural, systemic, psychological and cultural quadrants. This approach would subsume many of the mainstream conceptual approaches to sustainable development as ways of exploring sustainability within the systemic quadrant. It would also address the important issue of subjectivity and plural values discussed in Chapter 1. I will return to this proposed expansion in Chapter 9, where I will suggest changes to popular approaches to sustainable development that are consistent with a more integral approach.

I propose this expansion in the dimensions of sustainable development as a way of achieving greater epistemological balance. Wilber argues that Western civilisation relies heavily on knowledge from the objective exterior sciences, at the expense of subjective interior knowledge. I agree, and believe that only a civilisation that learns to balance objective and subjective ways of knowing can hope to navigate the pressing civilisational challenges discussed in Section 1.2. As Wilber (2003a, Part III, p.2) puts it: ‘An increase in exterior or social development can only be sustained with a corresponding increase in interior development in consciousness and culture’.

In Section 2.4, I also argued for the adoption of the integral theory of development to provide a stronger theoretical foundation for sustainable development. This has some important implications. It means that sustainable development policies and practices must find ways to include plural waves of development while also facilitating healthy personal and cultural development through waves and across streams. It also requires a recognition that sustainable development will not be achieved by going "back to nature". Instead, we must go "ahead to culture" by reaching mutual understanding and agreement on the problems faced by humanity and the best way to proceed.

In response to the second research question above, I outlined the methodological implications of integral theory in Section 2.5. In summary, I have adopted integral epistemology and use integral methodological pluralism as my guiding theoretical perspective. My primary methods are integrative or meta-paradigmatic practices, guided by the principles of nonexclusion, unfoldment and enactment discussed in Section 2.4.3. However, I also employ specific methods within each quadrant as required, including systems methods, phenomenological reflection, discourse analysis and participatory action research.

In Section 2.5.1, I argued that emerging applications of integral theory must undertake three tasks. First, they must identify relevant literature across the quadrants that is awaiting integration. Second, they must address evident research gaps across the quadrants. Third, they must start to integrate existing and new work across the quadrants. I will attempt all three tasks in this thesis for an integral approach to energy and climate policy. I will undertake the first task in Chapters 3, 4 and 5, which review objective and subjective literature on climate change and Australian policy practices. In Chapters 5, 6 and 7, I address research gaps that are evident from this review. Finally, in Chapters 8 and 9, I propose integral approaches to energy and climate policy development, and to sustainable development.

3. Objective Perspectives on Energy and Climate Change

Coal is a portable climate. It carries the heat of the tropics to Labrador and the polar circle; and it is the means of transporting itself whithersoever it is wanted. Watt and Stephenson whispered in the ear of mankind their secret, that a half-ounce of coal will draw two tons a mile, and coal carries coal, by rail and by boat, to make Canada as warm as Calcutta, and with its comfort brings its industrial power.

- Ralph Waldo Emerson

3.1 Introduction

In the next two chapters, I survey literature on energy and climate change, using the integral quadrants to guide my review. In this chapter, I consider literature that engages the behavioural and systemic quadrants; in Chapter 4, I consider literature that engages the psychological and cultural quadrants and literature that attempts integration across or within quadrants. Of course, the literature does not always fit neatly into any one quadrant, so the quadrant focus is flexible throughout, providing structure and guidance rather than rigid categories. The conclusions from my literature review are presented at the end of Chapter 4.

3.1.1 Objectives of the literature review

I have three main reasons for undertaking this literature review, linked to the research questions I outlined in Chapter 1 and the methodological tasks I proposed in Section 2.5.1. The first is to gather case-specific evidence to test the validity of Wilber's (2000c) argument that the subjective quadrants are marginalised by Western civilisation. The guiding research question here is:

- How adequately does the literature on energy and climate change consider and integrate the different quadrant perspectives?

In other words, I aim to identify existing work on energy and climate change that engages with each quadrant, including any work that adopts or approaches an integral perspective on climate change response. In addition, I aim to identify research gaps that I can address in subsequent chapters.

My second reason for undertaking this literature review is to understand the different perspectives that warrant inclusion in an integral response to climate change. I am guided here by the principles of integral methodological pluralism discussed in Section 2.4.3, which encourage inclusion but set boundaries on the validity of different perspectives. The research question here is:

- What behavioural, systemic, psychological and cultural perspectives need to be considered for an integral response to climate change?

My third reason for the literature review is to introduce concepts from the energy and climate change literature to which I will return in later chapters. Given the breadth of the available literature, my review is not exhaustive. Rather, I attempt to identify typical representative literature from particular quadrants and developmental lines, sufficient to allow orienting generalisations of the kind used by Wilber (2000c) in his development of integral theory. The concepts I introduce here will provide the foundation for the discussion in the remaining chapters.

3.1.2 Methodology

My methodological approach to the literature review comprised careful attention to journals and Internet sources dealing with energy and climate change for four years, combined with targeted searches for literature on particular topics as they became relevant. I did not commence the literature review with particular literature categories in mind. Instead, I allowed categories to emerge over time, in tandem with my deepening understanding of integral theory. The categories that did emerge spanned the quadrants and indicated the particular developmental lines that are crucial to climate change response. To finalise the literature review, I undertook targeted literature searches on developmental lines within particular quadrants that seemed important from an integral perspective but had not already emerged as important categories. The final categories structure Chapters 3 and 4. I adopt a critical perspective throughout the literature and policy review. Consequently, the cataloguing of literature is interspersed with critique, commentary, assessment and argument.

3.1.3 Chapter structure

I have divided this chapter into two parts. In general, Part A reviews literature that adopts a behavioural perspective and Part B reviews literature that adopts a systemic perspective. I have found that the bulk of the literature takes a collective or systemic perspective. This is unsurprising, given that climate change is a global problem involving complex system interactions and requiring a collective human response. However, some of the literature does adopt a more traditional empirical perspective including, I would argue, elements of the high-profile assessment work of the Intergovernmental Panel on Climate Change.

Part A. Behavioural perspectives

A behavioural perspective focuses attention on the empirical, biological and behavioural aspects of energy and climate change. Empirical work in this quadrant measures, for example, quantitative trends in energy consumption, greenhouse gas emissions, atmospheric greenhouse gas concentrations and global temperature. Researchers adopting a behavioural perspective often develop projections that extend these observed trends into the future as an input to policy development and planning. In Section 3.2, I discuss the empirical evidence for climate change and summarise relevant trends and projections.

A behavioural quadrant perspective also draws attention to the specific human behaviours or activities that underlie observed trends and projections. In this thesis, I am particularly interested in behaviours that consume energy. In Section 3.3, I discuss the behaviours underpinning energy consumption, recent trends in these behaviours that help to explain trends in energy consumption and explanations of behaviour and behavioural change in the literature.

Finally, a behavioural perspective focuses attention on the biological or evolutionary basis for particular behaviours. I consider biological theories of energy consumption in Section 3.4.

3.2 Empirical evidence for climate change

Human-induced climate change is a theoretical proposition that has accumulated extensive empirical evidence, particularly over the last two decades. In this section, I will briefly summarise empirical evidence for climate change and relevant trends and projections. It is important to stress that much of the empirical evidence comes not from the application of empiricism to individual holons, but from the application of empirical systems theory to collective holons. For convenience, here I discuss empirical evidence from both sources to provide a foundation for further discussion. I begin with a brief discussion of the Intergovernmental Panel on Climate Change (IPCC) and its influential perspective.

3.2.1 The Intergovernmental Panel on Climate Change

In 1988, the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) established the IPCC to 'assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation' (IPCC 1998, p.1). Membership of the IPCC is open to all members of the United Nations and WMO. The IPCC is primarily a scientific organisation, however, governments participate in the approval of major assessment conclusions (Siebenhüner 2002).

The IPCC does not conduct original research. Rather, it releases periodic assessment reports prepared by contributing authors from around the world that summarise current understanding of climate change. It released its *First Assessment Report* (FAR) in August 1990 (Houghton, Jenkins & Ephraums 1990; IPCC 1991; Tegart, Sheldon & Griffiths 1991), its *Second Assessment Report* (SAR) in December 1995 (IPCC 1995) and its *Third Assessment Report* (TAR) in four volumes in 2001 (IPCC 2001a, 2001b, 2001c, 2001d). There are three working groups within the IPCC, each of which contributed a volume to the TAR. Working Group I reported on 'The Scientific Basis' for climate change (IPCC 2001d), Working Group II reported on 'Impacts, Adaptation and Vulnerability' (IPCC 2001a) and Working Group III reported on 'Mitigation' options (IPCC 2001b). The fourth volume of the TAR was a 'Synthesis Report' prepared by the three working groups (IPCC 2001c).

The IPCC's assessment reports are highly influential; they are the primary reference source on climate change and establish the agenda for further research. The *Principles Governing IPCC Work*, from which I drew the earlier quotation, indicate that the IPCC aims to adopt an objective perspective that separates facts from values and is 'neutral with respect to policy' (IPCC 1998, p.1). From an integral perspective, such policy neutrality is impossible; the values of the authors will always shape the choice and expression of the material in the assessment reports and the way different policy options are presented. Nevertheless, the pursuit of scientific objectivity and neutrality is valid for methodological approaches that seek to generate knowledge within the behavioural and systemic quadrants. Work that adopts an objective perspective certainly has a place in any integral policy approach.

Although the IPCC reports predominantly adopt an objective perspective, consistent with the *Principles Governing IPCC Work*, they also include valuable reviews of literature generated using methods associated with the subjective quadrants. For example, Section 5.3.8 of the Working Group III report reviews social, cultural and behavioural norms and aspirations and concludes that:

> …the most significant barriers to GHG [greenhouse gas] mitigation, and yet the greatest opportunities, are linked to social, cultural, and behavioural norms and aspirations. In particular, success in GHG mitigation may well depend on understanding the social, cultural, and psychological forces that shape consumption patterns (IPCC 2001b, p.367).

This section of the TAR drew heavily on the outcomes of an IPCC Expert Meeting on social, behavioural and cultural aspects of climate change mitigation policies, held in 2000 (Jochem, Sathaye & Bouille 2000). I will return to this material in my review of the subjective literature, in Chapter 4.

While the TAR does engage with subjective material, the space devoted to this material is far less than the space devoted to objective material. Section 5.3.8 of IPCC (2001b) spans seven pages of a 54-page chapter in a 750-page report. Most of the chapters address technological, economic and institutional issues. Subjective material receives even less attention in the other volumes of the TAR, which focus on scientific knowledge of the climate system and the potential impacts of climate change. If the space devoted to subjective material is an indicator of the perceived importance of that material, then the specific and influential case of the IPCC supports Wilber's (2000c) argument that subjective perspectives receive little attention in contemporary scientific practice. Nevertheless, the IPCC's assessment reports are excellent applications of synthesis and review *within* the objective quadrants, and I draw on these reports throughout this chapter.

3.2.2 The theory of climate change

In 1824, the physicist Jean-Baptiste Fourier published a paper in which he proposed that the atmosphere creates a natural greenhouse effect by allowing solar energy to pass through relatively unimpeded, but absorbing some of the energy re-radiated from the Earth (Fourier 1824). Scientists would later identify water vapour, carbon dioxide (CO_2) and methane (CH_4) as the main atmospheric gases contributing to this natural greenhouse effect. These greenhouse gases (GHGs) maintain the Earth's average temperature at about 15°C; without these GHGs, the Earth's average temperature would be about -18°C.

In 1896, the chemist Svante Arrhenius became the first to propose that anthropogenic emissions of CO_2 would strengthen the natural greenhouse effect, thereby raising the Earth's temperature (Arrhenius 1896). Carbon dioxide is only one GHG emitted as a result of human activities; others include methane, tropospheric ozone (O_3), nitrous oxide (N_2O) and halocarbons (e.g. chlorofluorocarbons, CFCs). In theory, higher atmospheric concentrations of GHGs will absorb more of the solar energy re-radiated from the Earth, making more energy available to the climate system. Among the predicted results are an increase in global average temperatures and an increase in the turbulence of the climate system, reflected in more frequent, and more intense, storm activity (IPCC 2001c, p.8 & 14).

3.2.3 Greenhouse gas emissions

It is not feasible to observe or measure annual anthropogenic GHG emissions, as the sources of these emissions are numerous and diffuse. Instead, national governments and other organisations compile emission inventories by identifying activities that generate GHGs, estimating their scale, and applying emission factors to develop emission estimates. One of the roles of the IPCC is to develop and advocate an agreed methodology for this process through its Task Force on National Greenhouse Gas Inventories.

The main GHGs implicated in climate change are CO_2, CH_4, tropospheric O_3 and N_2O. Fossil fuel combustion is the major source of anthropogenic CO_2 emissions, contributing about three quarters of the global total (IPCC 2001d, p.185). The remaining CO_2 emissions are due to land use changes, such as deforestation. Fossil fuel production and consumption also contributes around 20 to 30 per cent of total anthropogenic CH_4 emissions (IPCC 2001d, p.250), mainly as releases of CH_4 and natural gas (which contains CH_4) from coal mines, wells and pipelines. Other sources of CH_4 include decomposition of waste in landfills and agricultural activities. Tropospheric O_3 is generated primarily by photochemical reactions involving anthropogenic pollutants, including CH_4, nitrous oxides (NO_x), carbon monoxide (CO) and volatile organic compounds. Organic waste combustion, use of agricultural fertilisers, nylon production and fossil fuel-fired power stations are the main sources of anthropogenic N_2O emissions.

My focus in this thesis is on the contribution of the Australian energy sector to anthropogenic GHG emissions. According to Australia's National Greenhouse Gas Inventory, published by the Australian Greenhouse Office (AGO 2004d), Australia's total net GHG emissions in 2002 were 550.1 megatonnes of CO_2-equivalent (Mt CO_2-e).[23] Energy-related GHG emissions comprised 371.4 Mt CO_2-e, or 68 per cent of the total. Stationary energy emissions were 261.9 Mt CO_2-e, or 48 per cent of the total. Energy-related GHG emissions in Australia are growing in absolute terms and as a proportion of total GHG emissions. Emissions from Australia's stationary energy sector increased by 34 per cent over 1990 to 2002, while total GHG emissions rose by only 1.3 per cent (AGO 2004d). The rapid growth in energy-related emissions since 1990 has been largely offset, to date, by a substantial one-off reduction in emissions from land use change and forestry, associated with a significant reduction in land clearing in the early 1990s (Hamilton 2001).

According to Australia's official GHG emission projections, which include the impact of existing measures to reduce GHG emissions, energy-related emissions will grow to 419 Mt CO_2-e, or 140 per cent of 1990 emissions, by 2010 (Australian Government 2003b). Other sources of GHG emission projections for Australia include Dickson, Akmal and Thorpe (2003) and Foran and Poldy (2002). Both sources project substantial growth in Australia's GHG emissions in the absence of new policy measures to reduce emissions.

3.2.4 Atmospheric observations

As predicted by Arrhenius, anthropogenic GHG emissions have accumulated in the atmosphere, increasing atmospheric GHG concentrations. Atmospheric scientists have monitored atmospheric concentrations of CO_2 at Mauna Loa in Hawaii since 1957. Earlier atmospheric CO_2 concentrations have been estimated by, for example, measuring the CO_2 concentration of air trapped in Antarctic ice cores. According to these measurements, atmospheric CO_2 concentrations rose from an average of about 280 parts per million by volume (ppmv) in 1750 to about 367 ppmv in 1999, an increase of 31 per cent (IPCC 2001d, p.39). Over the same period, the atmospheric concentrations of CH_4 and N_2O increased by approximately 150 per cent and 16 per cent respectively (IPCC 2001d, pp.41-42).

[23] By convention, quantities of GHGs other than CO_2 are often expressed as **CO_2-equivalent** quantities, allowing the total amount of GHGs to be reported as a single figure. A quantity of GHG is expressed in CO_2-equivalent terms by multiplying by its **global warming potential**, a measure of its effectiveness in absorbing radiation relative to CO_2.

Coinciding with this increase in atmospheric GHG concentrations is an observed 0.6°C±0.2ºC increase in the global average surface temperature of the Earth during the 20th century (IPCC 2001d, p.26). Changes in precipitation and atmospheric moisture and reductions in snow cover and ice extent have also been observed over this period (IPCC 2001d, p.30). In Australia, the average temperature has increased by 0.7°C over the 20th century and rainfall reductions have been observed, particularly in the south-west of Western Australia (Pittock 2003, p.3).

3.2.5 The human contribution to climate change

Most scientists accept the theories and observations discussed so far, as evidenced by the near consensus on these matters presented in IPCC (2001d). However, the causal link between anthropogenic GHG emissions and observed changes in the climate system is still disputed by some scientists. The climate system is dynamic and changes can occur as a result of natural variations, for example in the amount of solar radiation reaching the Earth. In geological history, the Earth has often been much colder, and has sometimes been much hotter, than the current Holocene period in which human civilisation developed.

To separate the impacts of various factors on the climate system, atmospheric scientists use the concept of **radiative forcing**. Radiative forcing is 'an externally imposed perturbation in the radiative energy budget of the Earth's climate system' (IPCC 2001d, p.353). Positive radiative forcing adds radiative energy; negative radiative forcing reduces radiative energy. A net positive radiative forcing will tend, on an annual and global average, to increase the global mean equilibrium temperature of the Earth (IPCC 2001d).

Since 1750, the IPCC estimates that the well-mixed GHGs (CO_2, CH_4, N_2O and halocarbons) contributed a positive forcing of 2.43 watts per square metre (W/m^2), with CO_2 responsible for 60 per cent of the forcing, CH_4 for 20 per cent, halocarbons for 14 per cent and N_2O for 6 per cent (IPCC 2001d, p.393). Ozone depletion in the stratosphere has a cooling effect of about 0.15 W/m^2 while ozone in the troposphere (from human activities) has a warming effect of about 0.35 W/m^2. Scientific understanding of the other sources of positive and negative forcing, including variations in solar radiation, the cooling effect of sulphate aerosols and the impact of changes in the Earth's albedo[24], is low to very low (IPCC 2001d, p.37). However, the IPCC's simulations 'indicate that the estimated net effect of these perturbations is to have warmed the global climate since 1750' (IPCC 2001d, p.8).

The IPCC's assessment indicates that anthropogenic emissions of GHGs are the largest source of positive radiative forcing and therefore the major contributor to observed climate change since the Industrial Revolution. In its SAR, the IPCC reached the tentative conclusion that: 'The balance of evidence suggests that there is a discernible human influence on the global climate' (IPCC 1995,

[24] Albedo is the percentage of light reflected by a surface.

p.22). In its TAR, the IPCC strengthened this conclusion: 'There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities' (IPCC 2001d, p.10).

3.2.6 Projected climate change

Given the complexity of the Earth's climate system and uncertainties about the current and future impact of human activities on this system, developing projections of expected climate change is a very difficult task. One way to approach this task is to develop scenarios with different assumptions about how the future will unfold. The IPCC, in its *Special Report on Emissions Scenarios* (SRES), develops a series of reference GHG emission scenarios that do not incorporate any additional emission reduction initiatives beyond those already in place (IPCC 2000). The SRES scenarios are based on 'distinct narratives of economic development and demographic and technological change' (IPCC 2001d, p.223).

In the SRES scenarios, CO_2 concentrations in 2100 vary between 541 and 970 ppmv depending on the scenario assumptions. The IPCC (2001c, p.61) uses the SRES scenarios to estimate projected increases in temperature relative to the current global average temperature of about 15°C:

> The globally averaged surface temperature is projected to increase by 1.4 to 5.8°C over the period 1990 to 2100. This is about two to ten times larger than the central value of observed warming over the 20th century and the projected rate of warming is very likely to be without precedent during at least the last 10,000 years, based on paleoclimate data.

In summary, the empirical evidence for the theory of human-induced climate change is overwhelming. However, the magnitude of the human contribution to climate change and the possible future impacts of climate change remain very uncertain. In the next section, I consider some of the human behaviours that contribute to climate change.

3.3 Human behaviour and energy use

Energy use, specifically fossil fuel combustion, is the single largest source of positive radiative forcing contributing to climate change. A behavioural perspective focuses attention on individual energy-consuming behaviour. As Blake (1999, p.262) notes, 'both researchers and policy makers have increasingly acknowledged the key role that individual people play in the quest for sustainability'. In this section, I consider energy use in Australia, identify the individual human behaviours that create demand for energy and review behavioural perspectives in the literature.

3.3.1 Trends in primary energy consumption

Figure 3.1 shows the primary energy consumption (PEC) for Australia and the PEC per person over the period 1973-74 to 2001-02, drawing primarily on Bush et al (1999) and Donaldson (2002) for energy statistics and Australian Bureau of Statistics (ABS 2001a) for population statistics.

Energy use in Australia has consistently increased over the period shown, although the rate of growth has slowed from about 3.8 per cent per year in the 1970s to 2.5 per cent per year in the 1990s (Akmal et al 2004).

The Australian Bureau of Agricultural and Resource Economics (ABARE) publishes regular projections of Australian energy supply and demand. The latest projections were published in August 2004 and cover the period from 2001-02 to 2019-20 (Akmal et al 2004). According to these projections, Australia's PEC will grow from 5,084 petajoules (PJ) in 2001-02 to 7,544 PJ in 2019-20, an increase of 48 per cent over 18 years or 2.2 per cent per year. The projected PEC is shown in Figure 3.1, along with projections of PEC per capita derived using population projections from ABS (2000c). The figure indicates that the growth in Australia's energy use is expected to continue in the future, albeit at a slower rate. This trend is consistent with global energy consumption trends expected by the International Energy Agency (IEA 2002b).

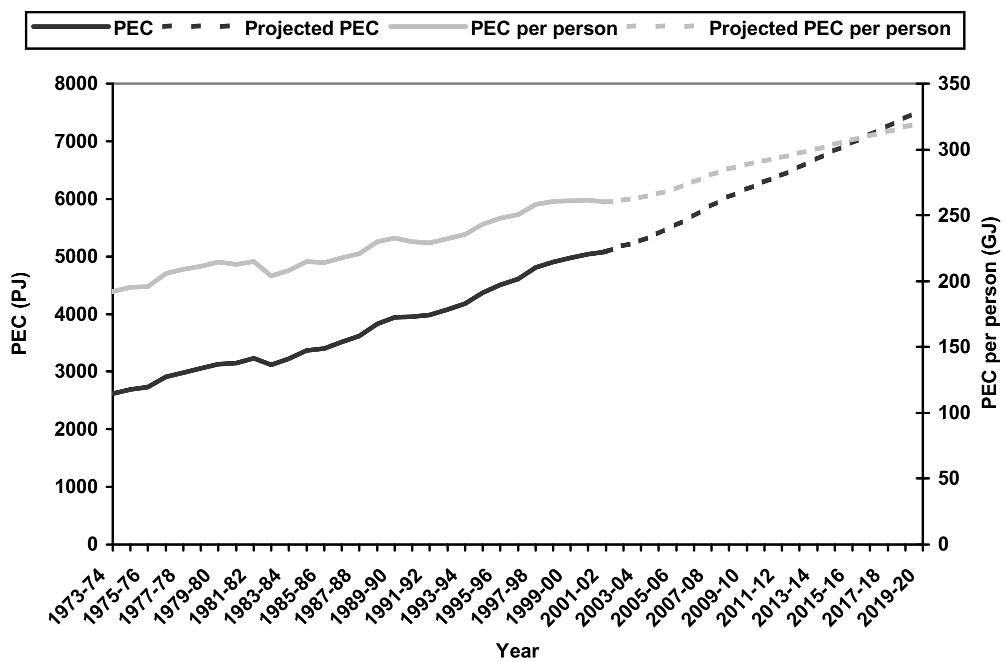

Figure 3.1: Historical and projected trends in primary energy consumption in Australia.

3.3.2 Sources of energy demand

The energy consumption trends discussed above are ultimately linked to consumer demand for the services that energy can provide or facilitate at the point of use, such as light, heat and mobility. In broad terms, 'around one third of Australia's end-use or final energy is used for movement, one half to provide heat at various temperatures, and the remainder to provide electricity' (Greene & Pears 2003, p.24). Figure 3.2 shows the contribution of different energy end uses to Australia's energy-related GHG emissions. This figure identifies the consumer behaviours that contribute most to Australia's energy-related GHG emissions, including movement (i.e. transport), space conditioning (i.e. heating, cooling and ventilating homes, offices and other buildings), heating water, operating home and commercial appliances (e.g. washing clothes and dishes, watching television), operating industrial equipment (e.g. manufacturing aluminium products, running industrial kilns), lighting buildings and preparing food (GWA & ES 2002b).

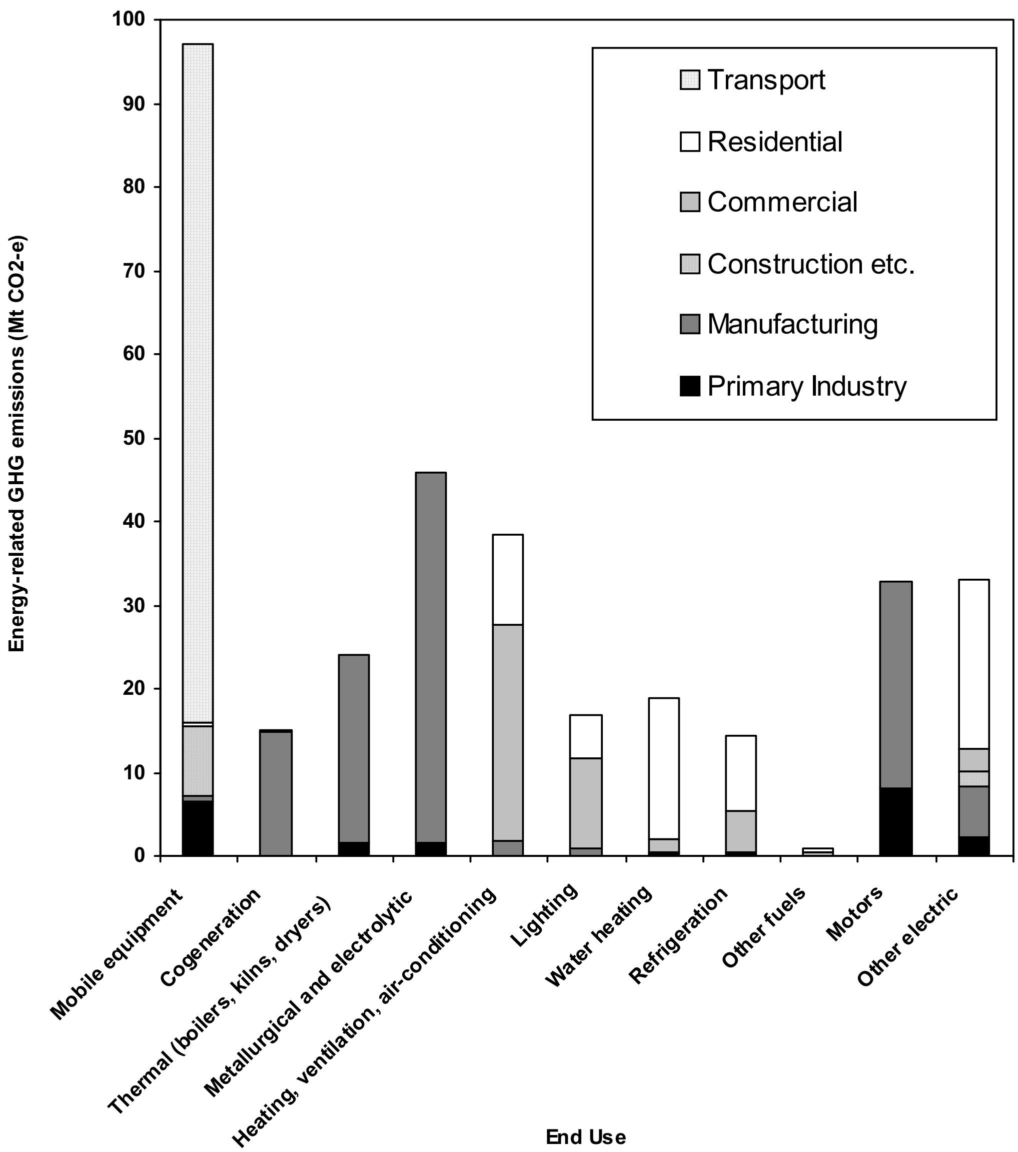

Figure 3.2. Energy-related GHG emissions allocated to end-uses.

Source: GWA & ES (2002b). Different end uses are shown along the horizontal axis. Within each column, the end uses are allocated to economic sectors, according to the legend.

3.3.3 Relevant behavioural trends

The contributions of different behaviours to energy consumption are dynamic, changing with the seasons, with climate and as a result of long-term behavioural trends. The IPCC (2001b, p.171) identifies 'socio-economic and behavioural trends' leading to increased energy consumption around the world, including:

> …increased size of dwelling units, increased sales of heavier and more powerful vehicles, growing vehicle kilometers travelled, reduced incentives for efficient use of energy or the purchase of energy efficiency technologies as a result of low real retail energy prices, increased consumption of consumer goods, and stimulated demand for energy-consuming products as a result of increased electrification.

All of these trends, perhaps with the exception of increased electrification, are evident in Australia.

In Australia, growth in energy consumption is strongest in the mining, manufacturing and construction and commercial sectors (Akmal et al 2004). Growth in these sectors is linked to economic growth and growing consumer demand for products (which must be manufactured and transported to markets) and services. Growth is weaker in the residential sector, however, the Australian Business Council for Sustainable Energy (BCSE 2003, p.4) identifies 'energy-intensive trends towards central heating, brighter lighting, wider use of halogen lighting and more and larger home entertainment systems and televisions'. Further, household size in Australia is declining, leading the number of houses to grow at a faster rate than population, while the average floor space of homes is increasing (ABS 2003c). Larger houses generally require more energy for space conditioning, while also typically having more, and larger, energy-consuming appliances. Population growth also creates upward pressure on energy consumption and GHG emissions.

3.3.4 Modelling human behaviour

Given the behavioural trends discussed above, any credible model of the future behaviour of the climate system must account for the influence of human behaviour, and related energy consumption, on that system. Modelling human behaviour is a formidable challenge, given 'the inherent reflexivity of human behaviour' and the diverse drivers for individual behaviour (IPCC 2001d, p.783). Historically, most models of human behaviour have employed simplistic economic assumptions, linking energy and resource use to population and income levels, but ignoring important social, cultural and institutional influences on behaviour (IPCC 2001b, p.367; 2001d, p.783; Wilhite et al 2000). The most common modelling assumption, drawn from neoclassical economic theory, is that people (and businesses) are rational economic individuals who have access to perfect information and will always seek to maximise their personal utility (Laitner, DeCanio & Peters 2000, p.1).

This neoclassical economic model of rational human behaviour has been criticised on empirical, logical and epistemological grounds (van den Bergh, Ferrer-i-Carbonell & Munda 2000). I will focus here on empirical critiques from the field of energy policy. Several decades of practical experience with energy efficiency and demand management programs that seek to influence human behaviour has provided extensive empirical evidence against the theory of utility maximisation (Dwyer et al 1993; Jaeger et al 1998; Lutzenhiser 1993; Wilhite et al 2000). Actual behaviour is influenced by the particular value commitments of the individual, the circumstances or context in which they find themselves, institutional constraints that place boundaries on possible behaviours, habit formation and the changing social construction of ideas like comfort, cleanliness and convenience (IPCC 2001b, pp.367-370; Laitner, DeCanio & Peters 2000; Shove 2003; Wilhite et al 2000).

Further, the behavioural models that have dominated social research on energy demand management define the individual 'as the locus of control and change' and fail to account for the social and cultural influences on behaviour (Wilhite et al 2000, p.114). In integral terms, these models focus on the individual holon and give too little attention to social holons.

Van den Bergh, Ferrer-i-Carbonell and Munda (2000) review alternative behavioural models, including 'bounded rationality' models that emphasise limited human cognitive capacity, information scarcity and transaction costs, hierarchical models that link behaviour to progressive need fulfilment, multicriteria evaluation models and models of behaviour under risk and uncertainty. Drawing on these models, empirical observations of actual human behaviour and evaluations of attempts to change behaviour, many authors now recognise the need for more sophisticated models of human behaviour that take into account psychological, social and cultural factors (e.g. Blake 1999; Laitner, DeCanio & Peters 2000; Shove 2003; van den Bergh, Ferrer-i-Carbonell & Munda 2000; Wilhite et al 2000). To varying degrees, these authors move beyond the boundaries of the behavioural quadrant towards an integral explanation of human behaviour. However, neoclassical economic models of human behaviour still dominate the climate policy debate; I will return to these models in Section 3.7.2.

3.3.5 Behavioural change

Given the evident contribution of human behaviour to climate change, the literature on energy and climate change gives much attention to strategies for behavioural change. Proposed strategies for achieving behavioural change are diverse. From a neoclassical economic perspective, changes to income and prices are the most efficient and effective ways to encourage behavioural change (van den Bergh, Ferrer-i-Carbonell & Munda 2000, p.55). Numerous such changes have been proposed, including changes to pricing or taxation regimes, creation of new markets, provision of incentives, rebates or subsidies and implementation of penalties (McKibbin & Wilcoxen 2002; Spash 2002; UNEP & IEA 2002). The objective is to change the consumer's utility function so that they will change their behaviour.

Van den Bergh, Ferrer-i-Carbonell and Munda (2000) point out that these price and income-based approaches are less attractive when alternative behavioural models are applied. Alternative behavioural models prompt alternative behavioural change strategies. For example, models of behaviour under uncertainty and risk point to policies that increase or maintain 'diversity of knowledge, technology and behaviour' as a way of responding to surprises (van den Bergh, Ferrer-i-Carbonell & Munda 2000, p.59). Other authors advocate education, programs encouraging personal commitment, regulatory and institutional change or establishment of new sociocultural relationships as ways of encouraging behavioural change (e.g. Mullaly 1998; Wilhite et al 2000, pp.119-120).

Behavioural change strategies must address habitual behaviour. Many energy-consuming behaviours take on a habitual quality over time. According to the IPCC (2001b, p.368):

> While some consumption may respond to perceived needs, much is habitual. Habit formation is an important barrier to GHG mitigation as consumers may be unwilling or unable to change their behaviour or technology choices…What was once luxury rapidly becomes habit, and then need.

While habit can act as a barrier to GHG mitigation, it can equally facilitate GHG mitigation if people develop habits that reduce energy consumption and/or GHG emissions. Numerous educational programs and resources, in Australia and elsewhere, seek to encourage these positive habits in individuals. For example, lists of energy saving tips almost invariably include a reminder to turn off lights when leaving a room, in the hope that such behaviour will become habitual (e.g. AGO 2003b, p.4).

In Chapter 4, I will examine psychological and cultural changes that can act as drivers for behavioural change.

3.4 Biological theories of energy consumption

3.4.1 Evolutionary biology and conspicuous consumption

The economic, psychological, social and cultural explanations for human behaviour discussed above all assume that individuals have some degree of control over their own behaviour. In contrast, evolutionary biologists draw attention to the importance of our genetic inheritance in determining our behaviour. Evolutionary biologists argue that many current human characteristics and behavioural traits developed because they, at one time, offered an evolutionary advantage allowing humans who possessed those behavioural traits to out-compete other humans, and other species. Thus, at least some of our behaviours are genetically determined rather than socially or culturally determined.

Richard Dawkins captured the essence of the argument for genetic determinism when he wrote 'that we, and all other animals, are machines created by our genes' (Dawkins 1990, p.2). Dawkins does not himself advocate genetic determinism; he recognises the role of culture in shaping human behaviour and the unique human ability to disobey genetic programming (p.3). He adopts a neutral position in the long-running debate over the relative roles of 'nature' and 'nurture' in determining human behaviour (p.3).

A more extreme position is evident in sociobiology, a branch of evolutionary biology initiated by Edward O. Wilson with the publication of *Sociobiology: The New Synthesis* (Wilson 1975). According to Kahn (Kahn 1999, p.26), 'Wilson argues that our complex behavioural responses are little more than genetically programmed behaviors to maximize genetic fitness…[and] in the final analysis psychology, sociology, and the other human sciences will be reducible to neurobiological processes'. That is, sociobiology argues that human behaviour is entirely explained by our evolutionary genetic inheritance. Like Dawkins, and guided by integral theory, I prefer to take a neutral position in this debate, rejecting the extremes of sociobiology and arguing that biology and culture are both important in determining human behaviour.

If our genetic inheritance has at least some influence on behaviour, then a biological perspective may help to explain some aspects of energy-consuming behaviour in terms of the evolutionary advantage that they conveyed at some point in human evolutionary history. The evolutionary psychologist Geoffrey Miller uses such an approach to argue that sexual selection explicitly favours excessive consumption and waste (Miller 2000). Drawing on Veblen ([1899] 2001) and Zahavi (1975; Zahavi & Zahavi 1997), Miller argues that conspicuous consumption and waste are ways for individuals to advertise their wealth and evolutionary fitness to members of the opposite sex. He uses the example of a male peacock's tail; a large, bright, heavy tail is a significant handicap, which only the fittest peacocks can afford. Similarly, Miller argues that humans have evolved to conspicuously display their wealth and status through excessive consumption and waste.

While I believe that Miller gives too little attention to the role of culture in shaping consumption, I agree that biological imperatives, such as the urge to attract a mate, may play a part in conspicuous consumption. Certainly, it is interesting to conceive of the purchase of a large house or inefficient four-wheel drive vehicle, or the unnecessary lighting of an office building at night, as displays of wealth and status, driven by a biological imperative to attract mates and pass on genetic material. However, even if there is a biological imperative for conspicuous consumption, there are no acceptable ways for policy to alter biology.[25] Policy must focus on the sociocultural context for behaviour and rely on the human ability to transcend biology through culture. There is ample evidence that this is possible.

[25] Assuming, as I do, that a desire to reduce energy consumption is insufficient ethical justification for genetic engineering.

3.4.2 Autopoiesis

As autopoiesis is one of the methodological categories identified in Figure 2.3, I have attempted, for completeness, to identify literature that explicitly applies an autopoietic perspective to issues relevant to energy policy and climate change response. I have been unable to identify any such literature. However, I do not propose to attempt to fill this gap in the literature, as autopoiesis is not one of my areas of expertise, and I believe that social autopoiesis is more likely to provide useful insights into climate change response. I will discuss literature that adopts a social autopoietic perspective in Section 3.8.4.

Part B. Systemic perspectives

A systemic quadrant perspective focuses attention on the behaviour of technological, economic, institutional and political systems, and their interactions with physical and ecological systems. Integral theory treats each of these systems as separate but interacting developmental lines. I will review literature dealing with each of these developmental lines in the sections below, focusing specifically on the energy supply and demand system and the ecological systems with which it interacts.

In the literature on climate change response, contrasting attitudes towards technology are evident. On the one hand, the current technological structure is implicated in observed and projected climate change; on the other, technological change is proposed as a key response to climate change. In Section 3.5, I consider the technological structure of the energy system and proposed technological options for climate change mitigation. The varied technologies that comprise the energy system have associated physical and ecological impacts, including their impact on the climate system. I consider the physical and ecological impacts of the energy system in Section 3.6.

As important as the physical structure and impacts of the energy supply and demand system, are the rules of economic exchange, institutional structures and political processes that govern or shape its operation. I consider the economics of climate change in Section 3.7 and the social and political institutions that are relevant to climate change in Section 3.8.

3.5 Technology and climate change

As noted above, the relationship between technology and climate change in the literature is ambivalent. On the one hand, fossil fuel-based energy technologies are demonised as the source of climate change. On the other hand, advanced energy technologies and climate change mitigation technologies are deified as the solution to climate change. I consider both perspectives in this section. I start by examining the technological structure of Australia's existing energy system.

3.5.1 Technological structure of the Australian energy system

Unruh (2000, p.819) defines 'a *technological system* as inter-related components connected in a network or infrastructure that includes physical, social and informational elements'. In Figure 3.3, I provide a schematic representation of the energy system as a technological system, distinguishing between energy supply and demand sub-systems. On the supply side, primary energy resources (e.g. fossil fuels, biomass and solar energy) are converted to energy carriers (e.g. electricity, processed natural gas and petroleum products) for delivery and distribution through networks of transmission and distribution lines, pipelines and vehicles. On the demand side, these energy carriers are used to fuel end use technologies (e.g. heaters, lights and motors), which provide desired energy services (e.g. warmth, illumination and torque).

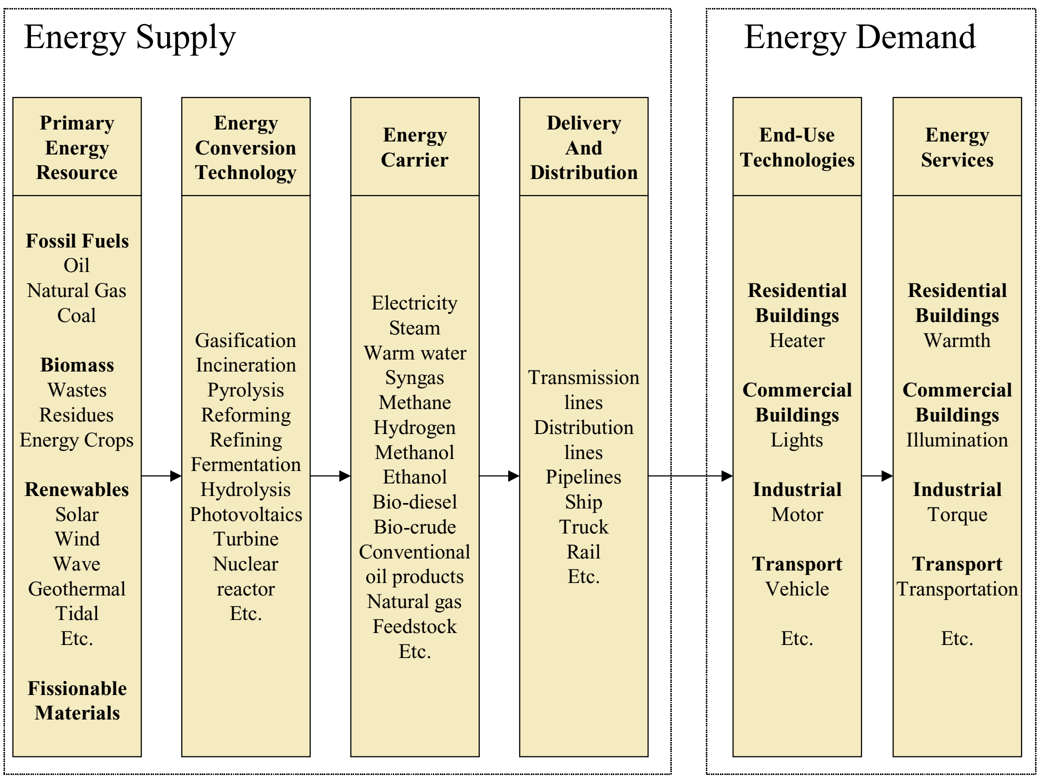

Figure 3.3. A schematic representation of the technological structure of the energy system. This figure is a modified version of similar schematic representations by Tuinstra et al (1999) and Audus (2000).

As noted in Section 3.3.1, Australia's PEC in 2001-02 was about 5,084 PJ (Akmal et al 2004). Fossil fuels (coal, oil and natural gas) supplied 95.3 per cent of Australia's PEC; renewable energy sources (biomass, biogas, hydroelectricity, wind and solar power) supplied the remaining 4.7 per cent (Akmal et al 2004). By way of comparison, fossil fuels supplied about 79.6 per cent of global PEC in 1998 (WEA 2000). Of the fossil fuels, coal supplies about 42 per cent of Australia's PEC, oil supplies 35 per cent, and natural gas supplies 19 per cent (Akmal et al 2004). Of the renewables, biomass supplies about 3 per cent of PEC, hydroelectricity supplies a little over 1 per cent, and the other sources supply no more than about 0.1 per cent each.

Due to losses during conversion and transport of energy, Australia's final energy consumption (FEC) at the point of use was only 3,132 PJ in 2001-02 (Akmal et al 2004), or 61.6 per cent of the PEC. Petroleum products provided almost 49 per cent of the FEC, electricity provided 22 per cent, natural gas provided 17 per cent, and biomass, coal and liquefied petroleum gas (LPG) provided most of the remainder. The transport sector consumed about 41 per cent of Australian FEC, followed by manufacturing and construction (29 per cent), residential (13 per cent), commercial and services (8 per cent), mining (5 per cent) and agriculture (3 per cent) (Akmal et al 2004).

About 95 per cent of petroleum products consumed in Australia are produced from crude oil in eight Australian oil refineries and distributed to customers by pipeline, road and rail, either directly or via storage terminals at port facilities. The remaining 5 per cent is imported from overseas refineries (Roarty 1999). Natural gas is produced at processing plants located at major gas fields around Australia and delivered through three separate pipeline systems, one serving Queensland, New South Wales, Victoria, South Australia and Tasmania, one serving Western Australia and one serving the Northern Territory (AGA 2003).

Electricity is generated predominantly from black and brown coal, natural gas and hydro (Akmal et al 2004). Thirty large, coal-fired, baseload power stations generate about 78 per cent of the electricity sent out to the grid in Australia (Akmal et al 2004; ESAA 2003). Natural gas-fired baseload power stations, peaking plants and cogeneration plants generate about 14 per cent of electricity sent to the grid. Hydroelectric power stations at large dams generate most of the remaining electricity, although diesel generators and small biomass, biogas and wind power industries contribute some electricity (Akmal et al 2004). An interconnected electricity grid serves Queensland, New South Wales, Victoria and South Australia. Separate electricity grids serve Tasmania, Western Australia and the Northern Territory, although the Basslink project will connect Tasmania to the other eastern states by 2005-06 (ESAA 2003).

I will consider the physical and ecological impacts of the technologies that comprise the Australian energy system in Section 3.6. Here, it is sufficient to note that the relatively high proportion of fossil fuels in Australia's primary fuel mix contributes to Australia's current position as the highest per capita emitter of GHGs of any nation in the world (Turton 2004). In the next section, I will consider some of the proposed technological responses to climate change.

3.5.2 Technological responses to climate change

The literature on technological responses to climate change is voluminous and varied. Chapters 3, 4 and 5 of IPCC (2001b) provide a detailed summary of the status and potential of proposed technological responses to climate change. More recent summaries are also available (e.g. Hoffert et al 2002; Pacala & Socolow 2004). I will provide a brief overview of technological responses to climate change here without going into detail on any particular technology. Figure 3.4 summarises technological responses to climate change according to their point of intervention in the energy system. Whereas Figure 3.3 depicted the supply side as the driver of the system, Figure 3.4 depicts the demand side as the driver of the system. I contend that this is a more realistic depiction of the energy system, as it is consumer demand for energy services that makes all the subsequent components and impacts of the system necessary. If there were no energy demand, the supply side would not exist.[26]

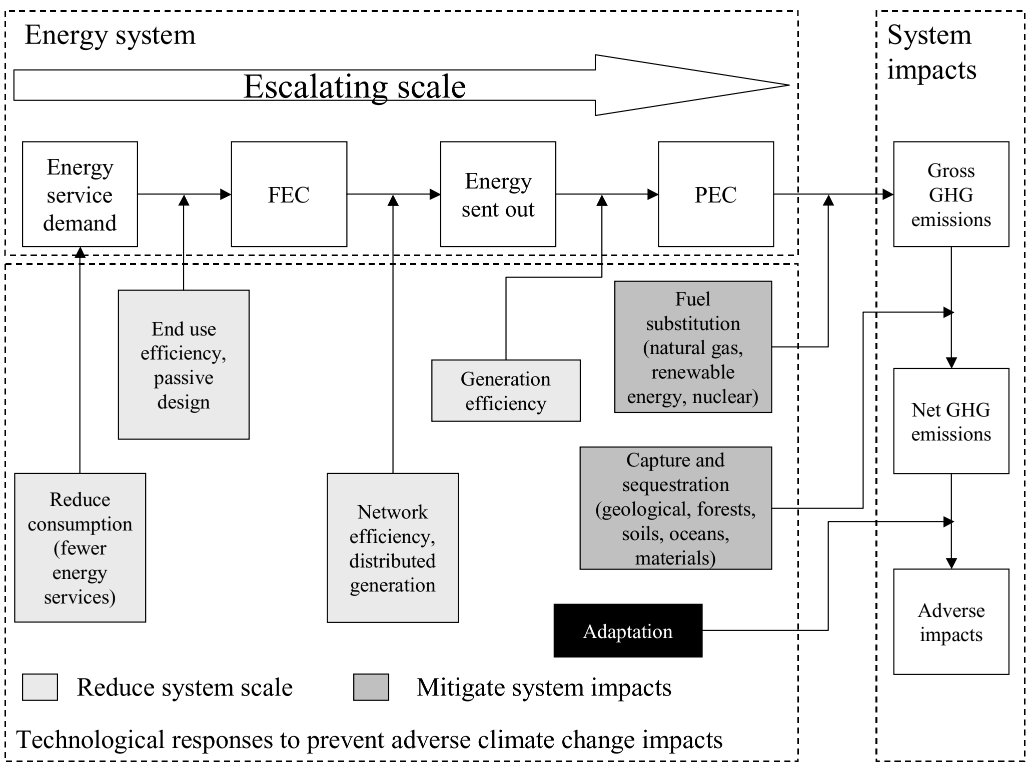

Figure 3.4. Summary of technological responses to climate change.

As indicated in Figure 3.4, the scale of the energy system increases from the demand-side to the supply-side, as a consequence of the second law of thermodynamics. Since energy conversion and

[26] I do not mean to imply that consumers have full control over their demand and are completely responsible for energy system impacts. In modern civilisation, a high proportion of consumer demand is effectively non-discretionary. Further, energy producers undoubtedly have an interest in stimulating demand and are therefore also complicit in energy system impacts.

transport is never 100 per cent efficient, the FEC is always greater than the minimum energy required to provide a service, the energy sent out is greater than the FEC and the PEC is greater than the energy sent out. Drawing on this insight, three types of technological response to climate change can be distinguished. The first set of responses, coloured light-grey in Figure 3.4, improve the efficiency of the energy system and therefore reduce its overall scale and consequent impacts. They are termed **demand management** responses, as they reduce overall energy demand. The second set of responses, coloured dark-grey in Figure 3.4, mitigate the impacts of the energy system by altering the fuel mix or the treatment of GHG emissions from the system. The third set of responses, coloured black in Figure 3.4, do not address the energy system at all, focusing instead on adaptation to energy system impacts. The second law of thermodynamics indicates that early intervention in the energy demand-supply-impact chain (i.e. energy conservation and efficiency improvements) will give a greater reduction in GHG emissions for a given amount of effort. In thermodynamic terms, adaptation is the least attractive option; energy is expended to create the problem and then more energy is expended to adapt to the problem.

In addition to technological responses, I have shown one behavioural response at the left of Figure 3.4 for completeness. If consumers opt to reduce their consumption by demanding fewer energy services, then the scale of the entire energy system diminishes. However, the decision to reduce consumption is difficult for most people, requiring personal change and cultural support. I consider sustainable consumption in more detail in Chapter 4. I will briefly describe each of the technological responses listed in Figure 3.4 below, before discussing their technical potential in Section 3.5.3.

Improving end use efficiency

Energy efficiency is defined as 'the ratio of usable energy output to energy input' (Hoffert et al 2002, p.982) or the useful work done per unit of energy consumed (Greene & Pears 2003, p.2). There is a theoretical minimum amount of energy required to deliver any given energy service. Improvements in the design, integration and maintenance of end use technologies and systems can raise end use efficiency, bringing the FEC closer to the theoretical minimum required to deliver desired energy services. The intention of end use efficiency measures is to provide the same level of energy service using less energy. There is a vast literature covering the practical potential of end use efficiency (e.g. EMET 2004a, 2004b; Energetics 2004), policy measures to realise that potential (e.g. Greene & Pears 2003; Worrell & Price 2001) and evaluation of efficiency programs (e.g. Meier 1997; Vine, du Pont & Waide 2001).

A particular type of end use efficiency measure, shown in Figure 3.4, is passive design. Passive design approaches take advantage of environmental energy fluxes to provide energy services in buildings. For example, appropriately oriented and designed buildings can rely on direct solar energy and natural ventilation for much of their heating and cooling needs, thereby reducing demand for other forms of energy. The literature includes numerous practical guides to passive design and sustainable design (e.g. Commonwealth Government 2002b).

Improving network efficiency and employing distributed generation

The quantity of an energy carrier sent out through a transmission and distribution network must be greater than the FEC to compensate for network losses, including heat losses in the electricity network and leaks and spills in petroleum and gas networks. Improvements in network efficiency can reduce these losses, thereby reducing the energy sent out. Network operators can improve efficiency by upgrading and maintaining transmission lines, pipelines, transport vehicles, substations and transformers. Hoffert et al (2002) consider more speculative ways to improve network efficiency, including the establishment of a global electricity grid using superconducting technologies.

The efficiency of electricity networks can be improved through greater use of distributed generation (DG). DG plants 'produce power on a customer's site or at a local distribution utility, and supply power directly to the local distribution network. DG technologies include engines, small turbines, fuel cells, and photovoltaic systems' (IEA 2002a, p.7). DG improves network efficiency by reducing the need for high voltage transmission lines, which are responsible for a high proportion of network energy losses. Cogeneration plants, also known as combined heat and power (CHP) plants, are an important type of DG. Typically located at an industrial facility, and fuelled by natural gas, cogeneration plants generate power and provide hot water or steam for other uses. Cogeneration is a way to ensure that a high proportion of the total energy in the fuel is converted to useful forms.

Improving generation efficiency

A substantial amount of energy is lost as heat, or used by power station operators during generation and processing of energy carriers at power stations and refineries. Improvements in generation efficiency can reduce the differential between PEC and energy sent out to transmission networks. The efficiency of power generation varies widely with technology, fuel and the age of the plant. In Australia, the best-practice sent-out efficiencies in 2000 for different power station fuels were 29 per cent for brown coal, 36.8 per cent for black coal and 40 per cent for natural gas (SKM 2000).[27] For comparison, world best-practice in 2000 was 44.7 per cent for brown coal, 49.4 per cent for black coal and 52 per cent for natural gas (SKM 2000).[28]

[27] Sent-out efficiency is the ratio of energy sent out to the network to the total amount of energy consumed during generation, including any energy consumed by the power station operator.
[28] The world best-practice figures for coal require integrated gasification combined cycle (IGCC) technology, which has a significantly higher capital cost than conventional coal-fired power station technology.

Fuel substitution

In Section 3.5.1, I discussed the fuel mix used to supply Australia's PEC and the predominance of fossil fuels in that fuel mix. The fuel mix determines the total GHG emissions from the energy system. For fossil fuels, CO_2 emissions are linked to the relative proportions of carbon and hydrogen in the fuel. A higher proportion of carbon results in higher CO_2 emissions. Thus coal generates about 88kg of CO_2 for every GJ burnt, whereas petroleum products generate between 71 and 75kg per GJ and Australian natural gas generates about 59kg per GJ on average (AGO 2004c). In contrast, renewable energy and nuclear power plants do not generate any GHG emissions during operation, although there may be significant GHG emissions during their manufacture and construction. To accurately compare GHG emissions from different technologies, the total emissions generated during the full fuel cycle, including mining, processing, transport, construction, conversion and operation emissions, must be considered. Several publications provide such comparisons for Australia (ACARP 2001; GWA & ES 2002a).

Fuel substitution is an attempt to reduce the overall GHG intensity of energy supply by preferentially using energy sources that generate lower GHG emissions, over the full fuel cycle, than those currently used. In general, this means substituting natural gas for coal and oil in power generation, natural gas for electricity or petroleum products at the point of use, renewable energy for fossil fuels, or nuclear power for fossil fuels. Another term for fuel substitution is *decarbonisation* of the energy supply, referring to a reduction in the amount of carbon emitted per unit of primary energy (Hoffert et al 2002).

As natural gas reserves are finite, and combustion of natural gas generates significant quantities of CO_2, substitution of natural gas for other fossil fuels (and for electricity generated from fossil fuels) is at best a transitional response to climate change that provides time to develop other energy sources and technologies with lower emissions. Substitution of renewable energy for fossil fuels is more likely to offer a long-term solution to climate change. Renewable energy is energy derived from natural flows of solar energy, wind, water and heat. Technologies that harness renewable energy flows include 'biomass, solar thermal and photovoltaic, wind, hydropower, ocean thermal, geothermal, and tidal' (Hoffert et al 2002, pp.983-984).

One of the technological barriers to wider use of renewable energy sources is the fact that many such sources (e.g. wind, solar, hydroelectricity) only provide energy when conditions are favourable, i.e. the wind is blowing, the sun is shining, water is flowing. As the supply profile does not necessarily match the demand profile, an energy network based substantially on renewable energy requires sophisticated grid management technologies, power conditioning and/or some form of energy storage or reliable backup generation to meet demand during periods when renewable energy fluxes are not available in particular areas.

The literature devotes significant attention to the development of a 'hydrogen economy', in which hydrogen is substituted for other energy carriers and used to generate electricity in fuel cells (e.g. ACIL Tasman & Parsons Brinckerhoff 2003; Dunn 2001). Hydrogen is an attractive energy carrier from a greenhouse perspective, as it generates no GHG emissions during use. However, if fossil fuels are used to generate the hydrogen, fuel cycle GHG emissions may be no lower, and may in fact be higher (Hoffert et al 2002), than emissions from direct combustion of fossil fuels. Hydrogen generated using low-emission technologies may play an important part in the technological response to climate change.

In some countries, although not in Australia, nuclear fission is used to generate power. Substitution of nuclear power for fossil fuel power is a possible technological response to climate change, as nuclear power does not generate significant GHG emissions during operation. However, nuclear fissile power has significant waste disposal problems, has been linked to nuclear weapons proliferation and is unable to provide a long-term solution to climate change due to fuel supply limitations (Hoffert et al 2002).

Capture and sequestration

Carbon dioxide capture and storage (CCS) is an option for reducing net GHG emissions. There are several ways in which GHG emissions can be captured and/or sequestered. Plants absorb CO_2 during their growth, so planting forests can capture CO_2 from the atmosphere. Fertilisation of ocean plankton and storage of CO_2 as magnesium carbonate bricks have also been considered in the literature as ways of storing CO_2 (Hoffert et al 2002). However, most of the literature focuses on capture of CO_2 from power stations.

In a fossil fuel-fired power station, CO_2 emissions could theoretically be separated from other flue gases, compressed, piped to a storage location and injected into geological formations or the ocean. While this process has not yet been achieved at any commercial power station, the component technologies are available and their integration at the scale of a power station is currently the subject of much research, backed by substantial funding (Saddler, Riedy & Passey 2004). CCS has the potential to reduce power station emissions by 90 per cent or more, assuming no leakage from the storage reservoir. However, there are significant technological, economic, ecological and political risks associated with the technology (Baer 2003; Saddler, Riedy & Passey 2004).

3.5.3 Technical potential of greenhouse abatement measures

The technical potential of a particular greenhouse abatement measure is the reduction in GHG emissions that it can feasibly provide, over a given period of time. Technical potential is typically assessed through the development of future scenarios derived using assumptions about baseline growth in GHG emissions, analysis of the impact of various technologies on the baseline emissions and, in some cases, a constraint on the future atmospheric concentration of CO_2. Azar and Schneider (2002, p.74) review several of these global energy scenarios and conclude that:

> These scenarios allow a substantial increase in the use of energy services in developing countries, further increases in the material well-being throughout the world, but still manage to stabilise atmospheric CO_2 concentrations at 415 ppm or below. In the near term, this is mainly done by increasing end-use energy efficiency and substituting natural gas for coal, but also by a rapid expansion of the use of renewables.

In its TAR, the IPCC (2001b, p.8) concludes that 'technologies that exist in operation or pilot stage today…could achieve a broad range of atmospheric CO_2 stabilization levels, such as 550ppmv, 450ppmv or below over the next 100 years or more'. Hoffert et al (2002) are more cautious, arguing that substantial research and development is still required to prepare technologies that can meet growing global energy demand while stabilising the climate, particularly in the second half of the 21st century. Responding to these authors, Pacala and Socolow (2004) identify fifteen feasible strategies that could each deliver global emission reductions of 1 gigatonne of carbon (GtC) per year or more by 2054, or 25 GtC in total over 2004 to 2054. The strategies include efficiency improvements for vehicles, buildings and baseload coal plants, reduced vehicle use, substitution of gas, nuclear power, wind power or PV power for coal power, capture and geological storage of CO_2, substitution of hydrogen or biomass fuels for fossil fuels in transport, reduced deforestation and conservation tillage. Pacala and Socolow argue that only seven of the fifteen strategies are required to stabilise global emissions at current levels and stabilise atmospheric CO_2 concentrations below 500ppm.

Other authors have developed feasible future energy supply scenarios that greatly reduce GHG emissions by 2050, using renewable energy (Sørensen & Meibom 2000) or using fossil fuels with capture and sequestration of CO_2 (Kuemmel 2000). Nakicenovic, Grübler and McDonald (1998) develop a series of six alternative energy scenarios, two of which achieve a two-thirds reduction in CO_2 emissions by 2100, compared to 1990 emissions. These two 'ecologically driven' scenarios rely on significant improvements in energy efficiency and a shift from fossil fuels toward renewable energy sources. One scenario largely phases out nuclear energy.

Australian authors have developed several scenarios that assess the technical potential of GHG abatement in Australia. The Australia Institute released a scenario in 2002 that demonstrated the technical feasibility of achieving a 60 per cent reduction in Australia's GHG emissions by 2050 using existing technologies (Turton et al 2002). The scenario relies mainly on substantial improvements in energy efficiency and major expansions in the use of wind to generate electricity and biomass to provide fuels and electricity. Another Australian scenario demonstrates the technical feasibility of achieving a 50 per cent reduction in CO_2 emissions from the stationary energy sector by 2040 (Saddler, Diesendorf & Denniss 2004). The scenario relies on substantial increases in energy efficiency and greater use of natural gas, wind power, biomass and solar energy.

The overwhelming sense from my review of these various scenarios is that technologies currently exist to reduce GHG emissions substantially by the middle of the 21st century. In the short to medium-term, energy efficiency improvements offer the greatest potential reductions in GHG emissions and are also attractive from the thermodynamic perspective outlined in Section 3.5.2. The IPCC (2001b, p.5) found that most of the potential reductions in global energy-related GHG emissions to 2010 are from energy efficiency gains in end-use sectors. In Australia, the Energy Efficiency and Greenhouse Working Group (E2WG 2003) estimates that improvements in energy efficiency have the technical potential to reduce energy consumption by 60 to 70 per cent in some economic sectors. Its conclusions are supported by several consultancy reports (e.g. EMET 2004a; Energetics 2004).

Substitution of natural gas for other fossil fuels is also an important short to medium-term response to climate change (IPCC 2001b, p.5). In the longer term, renewable energy and carbon dioxide capture and storage have the potential to provide very large reductions in GHG emissions. Given the available evidence, most of the debate over the feasibility of large emission reductions now focuses not on technological feasibility, but on economic feasibility (Azar & Schneider 2002). I will consider economic feasibility in Section 3.7.

3.5.4 Technological change

Given the environmental impacts of the existing energy system (see Section 3.6), and the availability of feasible technological responses to reduce that environmental impact, processes of technological change are an important focus in the literature. In particular, the literature draws attention to the slow rate of infrastructure replacement in the energy system (e.g. Lempert et al 2002) and the lock-in of dominant technologies (e.g. Unruh 2000, 2002) as barriers to climate change mitigation. These energy system characteristics create significant technological inertia. In Chapter 5, I use a review of past Australian energy projections to demonstrate the inertia that exists in Australia's energy system. Below, I consider the main sources of technological inertia identified in the literature.

Technology diffusion rates

Technology diffusion rates in the energy system are relatively low, which means that most of the energy system remains unchanged from year to year. For example, sales of refrigerators in Australia in 2000 were about 5 per cent of the total refrigerator stock; sales of clothes washers were about 6 per cent of total stock (EES 2001). It may take 20 to 30 years to completely replace the stock of long-lived appliances like clothes washers and refrigerators. Replacement of industrial equipment is often slower, and replacement of power stations is slower still; power stations may have a service life of 50 years or more. Roughly two-thirds of the electric power plants ever built in the United States are still in service, with some over 100 years old (Lempert et al 2002).

Technology diffusion rates can be altered through policies that increase the rate at which old technologies are retired. For example, the Ontario provincial government in Canada has committed to phase out coal-fired power by 2007 and is encouraging energy efficiency improvements and new generation to take its place (Ontario Ministry of Energy 2004). Lempert et al (2002) advocate market incentives and regulation as a way to drive higher rates of infrastructure retirement and technology diffusion.

Technological lock-in

Energy system inertia is also created by **lock-in** of particular technologies and associated institutions. Arthur (1989; 1994) and Unruh (2000; 2002) discuss processes of technological and institutional lock-in in the energy system. According to Unruh (2000, p.818):

> …large technological systems, like electricity generation, distribution and end use, cannot be fully understood as a set of discrete technological artifacts but have to be seen as complex systems of technologies embedded in a powerful conditioning social context of public and private institutions. [These Techno-Institutional Complexes (TICs)]…develop through a path-dependent, co-evolutionary process involving positive feedbacks among technological infrastructures and the organizations and institutions that create, diffuse and employ them.

A TIC can become locked in as a consequence of increasing returns brought about by increasing scale (Unruh 2000, p.827). As a TIC develops, numerous interests come to rely on the continued use of the associated technologies and therefore work to defend their continued use. For example, technology and industry standards, organisational routines and legal frameworks all co-evolve to support the TIC (Unruh 2002). In addition, 'an ecology…of suppliers, repairers [and] retailers' develops around the dominant technology (Inayatullah 2003, p.34). This ecology is reliant on the dominant technology and will protect its self-interest by resisting change. Consumer preferences and expectations adapt to the TIC over time and also resist change (Unruh 2002). In combination, these various aspects of lock-in make the transition to a new TIC difficult, even when new technologies and institutions have apparent societal advantages. Unruh (2000) argues that the dominance of fossil fuel-based technologies in the energy system, despite their apparent environmental impacts, is an example of the lock-in of an inferior TIC. Unruh uses the term 'carbon lock-in' to describe this situation.

Unruh (2000, p.827) describes how carbon lock-in occurs in the electricity generation sector:

> As the system expands, increasing returns mechanisms drive down costs and increase the reliability and accessibility of the system. The increased availability of cheap electricity tends to encourage increased consumption as more customers become connected and acculturated to the system, and innovations in secondary industries invent new applications and end-use technologies. In response to this induced demand, the government regulators build or approve the construction of more capacity to meet expanding needs, feeding a new growth cycle. As this feedback cycle continues, and the scale of the system increases, the technological and institutional forces of lock-in solidify.

As described by Unruh, carbon lock-in is a process of social autopoiesis or collective self-regulation. That is, the collective action of the many individuals and organisations that rely on the existing energy system effectively maintains the system and resists change. This has important implications for climate change response. If the energy system is locked into fossil fuel technologies, then the transition to a sustainable energy system must contend with deep systemic barriers. Unruh (2000, p.827) argues that techno-institutional lock-in creates 'pervasive market, policy and organizational failures toward the adoption of mitigating policies and technologies'. I will consider the institutional dimension of techno-institutional lock-in, and possible responses to lock-in, in Section 3.8.3.

Technological development and experience curves

Although the barriers created by lock-in can slow technological development, according to Unruh (2000, p.828), 'history shows that they can only delay the time when these technologies will be replaced by new dominant designs that resolve the existing environmental contradictions'. One of the major influences on the rate of technological development is accumulation of experience with the technology. Policy makers use a tool called an **experience curve** to represent and project the impact of cumulative production or use of a technology on price (IEA 2000, pp.10-11). A typical experience curve, plotted on a double-logarithmic graph with price as the vertical axis and some measure of experience (e.g. cumulative sales) on the horizontal axis, appears as a straight line sloping down to the right. This relationship has been found to hold for numerous energy technologies, although structural change in the market may alter this relationship (IEA 2000).

Experience curves are used in the literature to compare different technologies on the basis of their fixed **progress ratio** – the percentage reduction in price that results from a doubling of the cumulative experience with a technology (IEA 2000, p.12). For new technologies, doubling of experience and the associated price reduction occurs rapidly, whereas for established technologies it takes much longer to double experience and price reduction is slow. There is an extensive literature identifying experience curves and progress ratios for different technologies (e.g. Colpier & Cornland 2002; McDonald & Schrattenholzer 2002; Neij 1999). Policy makers can use these experience curves to estimate the rate of future technological development, identify the need for subsidies to develop further experience, and determine if, and when, a new technology may become cost-competitive with established technologies (IEA 2000, 2003a).

3.6 The physical and ecological impacts of the energy system

Any energy system, regardless of the technologies involved, has physical and ecological impacts. However, the nature and scale of these impacts varies for different energy technologies. In this section, I briefly survey the physical and ecological impacts of energy technologies, focusing particularly on the technologies that dominate Australia's existing energy system. In identifying these impacts, I am guided by the first three system conditions for sustainability defined by Robèrt et al (2002, pp.198-199) and discussed in Section 1.4.3.

3.6.1 Extractive impacts

Energy technologies that extract non-renewable resources from the Earth and do not replenish those resources are not sustainable. Over timescales relevant to human societies, fossil fuel resources are finite and non-renewable, as the ecological and geological processes required for fossil fuel formation take millions of years to complete. Thus Australia's energy system, which relies on fossil fuels for more than 95 per cent of its primary energy, is not sustainable. Of most immediate concern is Australia's growing reliance on imported oil, discussed by Akmal et al (2004, p.40) and Geoscience Australia (2004), as it increases Australia's exposure to a global oil market that is increasingly likely to experience physical and economic constraints on supply.

There is an extensive literature on oil supply and demand that seeks to identify the time remaining before oil production peaks and begins to decline (e.g. Bentley 2002; Campbell & Laherrere 1998; Deffeyes 2001; Hall et al 2003; IEA 2001). This is an area of great uncertainty; however, the most optimistic assessments do not place the year of peak production after 2030 and most are before 2020 (Hall et al 2003). The peak of global oil production does not mean that oil is about to run out, but that cheap oil will become increasingly scarce. Besides the threat of climate change, I believe that the threat of oil supply constraints is the most pressing motive for a transition to alternative energy technologies.

Renewable energy is a promising alternative to fossil fuel energy because it draws on environmental energy flows without significantly depleting the available energy resource. Materials must still be extracted from the Earth to manufacture renewable energy technologies, some of which may be scarce (e.g. indium, gallium and tellurium for photovoltaic cells) (Tsoutos, Frantzeskaki & Gekas 2005). Consequently, an energy system based on these technologies would only be sustainable if energy demand were stabilised and component materials were fully reused or recycled.

3.6.2 Climate change

Of all the physical and ecological impacts of the existing energy system, climate change is potentially the most serious. I discussed the convincing empirical evidence for human-induced climate change in Section 3.2. In this section, I will discuss the observed and projected ecological impacts of climate change, drawing predominantly on IPCC (2001a).

Observed impacts

According to the IPCC (2001a), the impacts of climate change are already evident. It is worth quoting at length a summary of the IPCC's (2001a, p.3) observations:

> Available observational evidence indicates that regional changes in climate, particularly increases in temperature, have already affected a diverse set of physical and biological systems in many parts of the world. Examples of observed changes include shrinkage of glaciers, thawing of permafrost, later freezing and earlier break-up of ice on rivers and lakes, lengthening of mid- to high-latitude growing seasons,

> poleward and altitudinal shifts of plant and animal ranges, declines of some plant and animal populations, and earlier flowering of trees, emergence of insects, and egg-laying in birds.

These changes were observed in long-term studies of physical and biological systems, typically over a period of 20 years or more. Similar impacts are identified in another recent review (Walther et al 2002).

In addition to these physical and ecological impacts, the IPCC (2001a, p.4) found 'emerging evidence' that human economic and social systems have been affected by recent increases in droughts and floods. Several studies indicate that the severity of the 2002 drought, the worst in Australian history, was increased by higher than normal temperatures linked to climate change (Karoly, Risbey & Reynolds 2003; Pittock 2003). It is clear, from the literature, that sensitive physical and ecological systems and indicator species are already experiencing climate-related disturbance.

Climate models

To move from observed impacts to possible future impacts, scientists employ climate models. Climate models attempt to mathematically represent the Earth's climate system for the purposes of studying climate processes and projecting the impact of human activities on the climate system (IPCC 2001d, p.94). The most complex models, called General Circulation Models (GCMs), use three-dimensional, non-linear equations to model different components of the climate system. As computing power grows, modellers are gradually integrating or coupling separate models developed for these different components. The most sophisticated GCMs currently integrate atmosphere, land surface, ocean and sea-ice, aerosol and carbon cycle models (IPCC 2001d, p.48).

Outputs from GCMs can be used to develop future climate scenarios. By combining climate scenarios with socioeconomic, land-use change, environmental and sea level rise scenarios, scientists can construct a plausible description of possible future conditions. According to the IPCC (IPCC 2001a, p.150): 'Most assessments of the impacts of future climate change are based on results from impact models that rely on quantitative climate and nonclimatic scenarios as inputs'. Some of the projected impacts are discussed below.

Projected impacts

If the atmospheric concentration of GHGs is not stabilised, the IPCC (2001a) projects various adverse consequences for nature, human society and the economy in the future. These consequences include higher average and extreme temperatures, higher heat stress mortality, a general reduction in crop yields in tropical, sub-tropical and mid-latitude regions, decreased water availability in many water-scarce regions, greater climate variability and instability, sea level rise and coastal inundation, increased risk of flooding, increased exposure to vector-borne and water-borne diseases and the extinction of species that are unable to adapt to the rapid rate of change (IPCC 2001a, pp.4-5).

For human systems, these adverse consequences are partially balanced by some positive consequences, including increased crop and timber yields in some regions, increased water availability in some areas and reduced winter mortality (IPCC 2001a, p.6). However, the IPCC (2001a, p.8) concludes that the aggregate impacts will be adverse for the majority of people even if temperature increases are towards the low end of IPCC estimates.

The projected impacts of climate change vary across and within regions, although all regions are likely to experience adverse impacts (IPCC 2001a, pp.14-15). The IPCC (2001a, p.594) concludes, with 'very high confidence', that 'Australia has significant vulnerability to changes in temperature and precipitation projected for the next 50-100 years…because it already has extensive arid and semi-arid areas and lies largely in the tropics and subtropics'. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) projects temperature rises of 1 to 6°C in Australia by 2070 (Pittock 2003). Likely results include more evaporation, more hot days, fewer cold days, decreased rainfall in the south and east of Australia, wetter summers and wetter autumns in some areas, more intense rainfall and an increase in tropical cyclone frequency and intensity. Overall, there will be less water available (Pittock 2003, p.59). Of particular concern in Australia are the threat to Alpine ecosystems from decreased snow cover, the risk of massive coral bleaching in the Great Barrier Reef and threats to rangelands and tropical rainforests (Howden et al 2003).

Regional variations in vulnerability to climate change are linked not only to climatic variations but also to variations in the economic resources available for adaptation. Consequently, poorer people in all countries but particularly in developing countries, are most at risk from climate change (IPCC 2001a, p.8). The majority of developing countries are located in tropical and sub-tropical regions, which are more prone to heatwaves and extreme storm events and more likely to experience crop yield reductions as temperatures rise. When adverse climate change does occur, poor people and nations lack the economic resources to adapt and respond.

Although impact projections are useful, it is important to recall that 'the climate system is complex, occasionally chaotic, dominated by abrupt changes and driven by competing feedbacks with largely unknown thresholds' making climate prediction 'difficult, if not impracticable' (Rial et al 2004, p.30). Abrupt or extreme change is always a possibility in a non-linear system subjected to forcing. The IPCC (2001c, p.81) raises the possibility that 'greenhouse gas forcing in the 21st century could set in motion large-scale, high-impact, non-linear, and potentially abrupt changes in physical and biological systems'. Examples include a 'large climate-induced increase in greenhouse gas emissions from terrestrial ecosystems, a collapse of the thermohaline circulation, and disintegration of the Antarctic and the Greenland ice sheets' (IPCC 2001c, p.82).

Evidence from polar ice cores indicates that large-scale changes can occur on a decadal scale, with severe consequences for biophysical systems (IPCC 2001c, p.142). As the functioning of the climate system is not completely understood, the risk of exceeding threshold limits in the system that would trigger abrupt climate change is uncertain (Rial et al 2004).

Stabilising the climate

In a sustainable energy system, terrestrial, ocean or artificial sinks would absorb all anthropogenic GHG emissions, leaving no *net* emissions to the atmosphere. This would prevent further accumulation of GHGs in the atmosphere, allowing the climate system to stabilise at a particular GHG concentration. In 1990, the IPCC estimated that an immediate reduction in global anthropogenic emissions of 60 to 80 per cent was necessary to bring global GHG emissions in line with the absorptive capacity of natural sinks and stabilise atmospheric GHG concentrations at then current levels (Watson et al 1990, p.5).

In recent reports, the IPCC has avoided definitive statements of the magnitude of emission reductions required to stabilise the climate, stating only that: 'Eventually CO_2 emissions would need to decline to a very small fraction of current emissions' (IPCC 2001d, p.12). Rather than specify a global GHG reduction target, the approach taken by the IPCC in the TAR is to discuss emission scenarios from the literature in which the atmospheric concentration of CO_2 is stabilised at various levels, mainly between 450 ppmv and 750 ppmv, in 2100 (IPCC 2001b, pp.147-156). The emission paths, and the eventual CO_2 emissions in 2100, vary in each scenario. In general, a higher CO_2 concentration at stabilisation allows more emissions during the 21st century and a higher equilibrium level of annual emissions. Higher equilibrium emissions are possible because the total volume of GHGs that undergoes natural degradation is higher when atmospheric GHG concentration is higher.

There is much debate, and no consensus, over an appropriate target for the maximum atmospheric GHG concentration and the timeframe for achieving that target. Given the GHG emissions that have already occurred, and those expected during the 21st century, none of the scenarios reviewed by the IPCC contemplate a return to pre-industrial GHG concentrations this century. This may, however, be an appropriate long-term objective, requiring significant enhancement of natural and artificial GHG sinks to achieve net removal of GHGs from the atmosphere. Since the release of the *Special Report on Emission Scenarios*, the most popular CO_2 stabilisation level in mitigation scenarios reviewed by the IPCC is 550 ppmv (IPCC 2001b, p.148), roughly corresponding to a doubling of pre-industrial CO_2 concentrations.

In general, higher GHG concentrations at stabilisation correspond to greater impacts on ecological and social systems. The best estimates presented in the TAR indicate that stabilisation of CO_2 concentrations at 450 or 550 ppmv by 2100 would lead to respective increases in global mean temperature over 1990 to 2100 of between 1 and 2°C and between 1.5 and 3°C (IPCC 2001d, p.559). A 1 to 2°C warming by 2100 would lead to some regional changes that could irreversibly damage sensitive natural systems, such as coral reefs, mangroves and montane ecosystems, and lead to the loss of some species, particularly those that are already endangered (IPCC 2001a, p.84). Higher concentrations of CO_2 at stabilisation would, of course, lead to greater temperature increases, greater impacts on natural systems and possibly adverse impact on food production (IPCC 2001a, p.84). Parry et al (2001) analyse the number of people at risk of water shortage, malaria, hunger and coastal flooding at different stabilisation levels compared to a scenario in which there is no mitigation of emissions. They find that hundreds of millions of people are at risk for any stabilisation target above 550 ppmv. Even at 550 ppmv, tens of millions of people are at risk of hunger and coastal flooding and hundreds of millions of people are at risk of water shortage and malaria.

The choice of stabilisation target is ultimately a subjective one, dependent on the value an individual places on natural systems and other people, and the level of risk he or she is willing to accept. My personal preference is for stabilisation of CO_2 concentrations at 450 ppmv by 2100, followed by gradual reduction to pre-industrial concentrations, as I believe that higher concentrations are likely to result in unacceptable damage to biodiversity, exposure of people to risk and risk of abrupt climate change.

According to the TAR, stabilisation of CO_2 at 450 ppmv would require a reduction of annual global CO_2 emissions to somewhere between 2 and 5 GtC by 2100 (IPCC 2001b). This requires global CO_2 emission reductions by 2100 of between 38 and 75 per cent from 2000 levels. The large range of uncertainty is a consequence of different demographic and economic assumptions in different scenarios, and varying assumed emissions trajectories over the 21st century.

3.6.3 Local and regional pollution

In addition to GHGs, fossil fuel combustion generates air pollutants, including particulates, hydrocarbons, ozone, carbon monoxide, nitrogen oxides, sulphur dioxide and lead. These pollutants can contribute to photochemical smog, haze and regional acidification (acid rain), particularly around large power stations and urban areas. They may also have serious health impacts. Biomass and biogas combustion also generates air pollutants, especially particulates. The pollutants of most concern in Australian cities are ozone and particulates, generated by motor vehicles and wood fires (DEH 2004). Renewable energy technologies, with the exception of bioenergy, generate few emissions during operation.

Energy technologies may also contribute to land and water pollution during their life cycle as a result of fuel and material extraction, processing, transport and manufacturing processes.

3.6.4 Other environmental impacts

Energy technologies have a range of other environmental impacts. Australia's large-scale centralised energy system has significant land use impacts. Central power stations require a large area of land, including a buffer zone, which cannot be used for other purposes. Large-scale transmission networks also require substantial land, albeit in relatively narrow corridors. Some energy technologies can be co-located with other land uses. Wind turbines can be located on agricultural land, photovoltaic cells can be located on roofs and cogeneration plants can be located at the industrial facilities that they serve. This reduces land use impacts.

The energy system also has visual impacts. Large power stations and refineries, high voltage transmission networks and natural gas pipelines are very visible. Although it is a matter of personal preference, some people believe that this infrastructure detracts from the landscape. This aesthetic preference extends to the local electricity distribution network. According to a recent inquiry in NSW, 'many people believe the overhead lines detract from views and streetscapes in cities and neighbourhoods across NSW' (IPART 2002a, p.i). Wind farms in Australia have been opposed for their visual impacts, particularly when sited in scenic coastal areas.

Other impacts are specific to particular technologies. Wind turbines are noisy and can pose a threat to bird life. Bioenergy requires a source of biomass that must be harvested, processed and transported. In some cases, this biomass may be sourced from native forests, or from biomass plantations that replaced native forests, resulting in negative impacts on biodiversity. Hydroelectricity and some forms of tidal power require the construction of impoundments that can flood local areas and alter local hydrological regimes, with consequent ecological impacts. The greenhouse benefits of renewable energy technologies must be carefully weighed against any negative impacts on a case-by-case basis. However, generally speaking, the environmental impacts of fossil fuel technologies substantially outweigh those of renewable energy technologies.

3.7 Greenhouse economics

Despite the evident environmental benefits of renewable energy technologies, and their technological maturity, the proportion of energy supplied by these technologies in industrialised countries remains low. The reasons cited for this low penetration are predominantly economic, and it is to the economics of climate change that I now turn. Of all the perspectives on climate change considered in this chapter, it is the economic perspective that has generated the most extensive debate, reflected in a vast literature. For this review, I have divided the literature into four categories. First, in Section 3.7.1, I consider the role of energy in the economy. Second, in Section 3.7.2, I consider economic analysis of climate change and the issues that need to be addressed when assessing the costs and benefits of climate change and of mitigation options. Third, in Section 3.7.3, I review the economics of demand side and supply side climate change mitigation options in the energy system. Finally, in Section 3.7.4, I consider the role of markets and market instruments in climate change mitigation.

3.7.1 Energy and the economy

Energy consumption and economic activity are closely linked. This point is constantly stressed in the literature, including Australia's most recent energy policy statement:

> Energy is a basic input into virtually every aspect of personal and business activity…[It] is a fundamental part of life in Australia and the energy sector is an essential component of the Australian economy. Expenditure on energy in Australia in 2002–03 was about $50 billion. Energy exports of coal, natural gas, oil, petroleum products and uranium amounted to $24.2 billion…Energy is a significant input for major industries such as aluminium, steel, cement, and pulp and paper; their international competitiveness relies on access to competitively priced, reliable energy (DPMC 2004, p.35).

In general, the economic activities that are measured by GDP are also energy-consuming activities, so economic growth and growth in energy consumption are closely linked. The amount of energy consumed to deliver a unit of GDP is referred to as the **energy intensity** of an economy. Energy intensity tends to decline over time as more efficient ways to generate GDP are found. Energy intensity also varies substantially across countries. Australia's energy intensity is higher than the Organisation for Economic Cooperation and Development (OECD) average and that of most EU countries, but lower than that of North American countries. Australia's energy intensity declined over 1990 to 2000 by more than the OECD average, but less than most European countries and the United States (ABS 2003a). Generally speaking, a reduction in energy intensity will correspond to a reduction in GHG emission intensity, so reducing energy intensity is desirable for climate change mitigation.

Influences on energy intensity

Tedesco and Thorpe (2003) use decomposition analysis to identify the influences on energy intensity over 1973-74 to 2000-01. Over that period, PEC grew by 92.7 per cent, while production (i.e. economic activity) grew by 135.5 per cent. That is, energy intensity declined over the period considered. Tedesco and Thorpe identify two main reasons for the decline. First, the structure of the economy changed over the period considered; economic activity shifted out of energy-intensive sectors, to the extent that energy consumption would have fallen by 12.5 per cent, all other things being equal. This structural trend reflects an ongoing shift towards a service-oriented economy. Second, changes in the fuel mix used to supply PEC tended to decrease energy consumption by 6.9 per cent. This reflects a shift in the fuel mix towards natural gas, which burns with higher efficiency than coal and petroleum products. The overall technical efficiency of energy generation, transport and use declined very slightly (by 0.5 per cent) over 1973-74 to 2000-01, so efficiency improvement made no net contribution to the lower PEC growth rate relative to GDP.

Saddler, Diesendorf and Denniss (2004) point out that the apparent decline in technical efficiency does not mean that energy efficiency actually decreased within particular economic sectors. Rather, due to the level of sectoral aggregation used by Tedesco and Thorpe, the trends may be explained partly by shifts to more energy intensive sub-sectors within a particular sector. Equally, a decline in prices per unit of output could contribute to a decline in real energy intensity.

Hamilton and Turton (2002) use decomposition analysis to examine the influences on growth in CO_2 emissions. According to their analysis, Australia's population grew by about 22 per cent over 1982 to 1997, while economic activity per person grew by about 33 per cent. This indicates that both population growth and growth in per capita economic activity are important contributors to growth in PEC in Australia (and hence to growth in GHG emissions). The contribution of population growth to PEC growth is higher in Australia than in most OECD countries, as Australia's rate of immigration is comparatively high.

The strong influence of economic growth on PEC is emphasised by my analysis of ABARE's past energy projections, in Chapter 5. My analysis shows that ABARE's projections of future PEC are remarkably accurate as long as economic growth remains steady, but are subject to significant short-term errors when there are unexpected fluctuations in economic cycles, such as recessions.

Given the strong links between energy consumption, economic activity and population, the literature describes two broad strategies available to stabilise or reduce energy consumption. The first is to move to a **steady-state economy** in which there is no material growth and a stable population (e.g. Daly 1996). The second is to **decouple** economic growth from growth in energy consumption by reducing the energy intensity of economic activity (e.g. Hawken, Lovins & Lovins 1999; von Weizsacker, Lovins & Lovins 1997). I discussed aspects of the economic growth debate in Section 1.4.2, and noted that the sustainability of economic growth remains an empirical question. Similarly, the appropriate balance between acceptance of lower economic growth rates and decoupling remains an empirical question.

Energy security

Given the importance of energy to economic activity, security of energy supply is a major focus in industrialised countries. As noted in Section 3.6.1, the main area of concern for Australia is security of oil supply. Australia is a net exporter of black coal, LPG, liquefied natural gas (LNG) and uranium, but is partially reliant on foreign oil imports to meet oil demand (Akmal et al 2004). Akmal et al (2004) project that Australian crude oil production will fall by 5.5 per cent over 2001-02 to 2019-20, while domestic oil consumption will increase by 43 per cent. As a result, Akmal et al project that net imports of crude or refined oil will increase from 17 per cent of domestic consumption in 2001-02 to 46 per cent in 2019-20. Projections by Geoscience Australia (2004) are less optimistic. Under their medium (50 per cent exceedance probability) scenario, net imports of crude oil, condensate and refined petroleum products would reach 78 per cent of domestic consumption by 2020.

There are several ways in which increasing reliance on foreign oil imports may affect Australia's economy. First, there may be a substantial impact on Australia's balance of payments. The Australian Petroleum Production and Exploration Association (APPEA 2004) estimates that, assuming a long-term oil price of $US30 per barrel, Australia's oil import bill will be $US24 million per day by 2010. Second, oil production is an important source of government income, through taxes and royalties. APPEA (2004) estimates that lost government tax revenue from declining Australian oil production will amount to $US12 million per day by 2010. Third, reliance on oil imports leaves Australia's economy vulnerable to oil shocks – supply disruptions and/or price increases resulting from global or regional conflicts, production problems, natural disasters or declining supply. These energy security issues provide an economic incentive to develop alternative energy sources that are domestically available, including renewable energy sources.

3.7.2 Economic analysis of climate change

Economics has been defined as 'the study of how societies use scarce resources to produce valuable commodities and distribute them among different people' (Samuelson & Nordhaus 2001, p.4). Consistent with this definition, economic analysis of climate change investigates how much, if any, of society's scarce resources should be dedicated to climate change mitigation. The dominant technique used for this investigation is quantitative cost-benefit analysis (van den Bergh 2004). There are three tasks in a quantitative cost-benefit analysis of climate change mitigation. The first is to assess the cost of projected climate change, or the benefit of climate change mitigation. The second is to assess the cost of various mitigation options and their distributional impacts. The third is to compare the costs and benefits and adopt those measures that have a net benefit to society.

In practice, each of these tasks is exceedingly difficult and the results depend heavily on the input assumptions. According to the IPCC (2001b, p.9):

> Costs and benefits estimates, inter alia, depend on revenue recycling, and whether and how the following are considered: implementation and transaction cost, distributional impacts, multiple gases, land-use change options, benefits of avoided climate change, ancillary benefits, no regrets opportunities and valuation of externalities and non-market impacts.

Baseline assumptions, the choice of mitigation target and the choice of discount rate are also important sources of variation in cost and benefit estimates (IPCC 2001b, p.9). IPCC (2001a, Chapters 2 and 19) considers issues relevant to costing or valuation of climate change impacts and IPCC (2001b, Chapter 7) reviews methodologies for costing mitigation options. I will briefly draw out some of the key issues for economic analysis of climate change below.

The cost of climate change

Costing and valuation methods have been used to assess the cost of adaptation to climate change and of residual damages after adaptation (IPCC 2001a, p.120). The IPCC (2001a, p.940) reports on four studies that denote the aggregate impacts of 1 to 2.5°C of global warming in monetary terms.

The estimates range from a reduction in world GDP of 2 per cent to an increase in world GDP of 2.3 per cent. However, these estimates are highly speculative and use very different assumptions, making any comparison difficult.

There are at least two serious limitations on the policy value of any monetary estimate of the aggregate impact of climate change. First, deep uncertainty about the risk and impact of extreme climate impacts, linked to non-linearity in the climate system, makes accurate economic valuation of these impacts impossible. Quantitative economic analyses of climate change fail to adequately address surprise events and catastrophes that may result from non-linear behaviour of the climate system (Spash 2002, p.19; van den Bergh 2004). Further, current studies 'omit an assessment of the costs of adaptation' (van den Bergh 2004, p.386). Monetary estimates of climate change impacts are at best incomplete and, at worst, misleading in that they imply a degree of predictive certainty that simply does not exist (see also Lempert & Schlesinger 2000).

Second, there is the question of how to value unique threatened systems, such as coral reefs, biodiversity "hot spots" and indigenous communities (IPCC 2001a, p.957). These public assets have no market value. Various methods have been developed to value non-market assets, including contingent valuation, hedonic pricing methods, impact pathway analysis and benefit transfer (IPCC 2001b, pp.463-465). These methods can improve understanding of the value that people place on particular public assets, but have numerous caveats and limitations. They are no more able than market valuation methods to cope with uncertainty. For example, if it is not known that a particular species is vital to ecosystem viability, that species will be undervalued. In addition, there are ethical objections to monetisation of certain climate change impacts, such as the value of a human life (van den Bergh 2004) or the existence value of an irreplaceable ecosystem. These ethical objections are linked to a fundamental limitation of monetisation – the assumption that money can buy back the thing that is being valued. No amount of money can buy back a human life or a stable climate.

I would argue that the problems described above render any quantitative estimate of the cost of climate change almost meaningless and consequently impose significant constraints on the potential role of traditional predictive cost-benefit analysis in guiding climate change mitigation policy. Lempert et al (2000) discuss an exploratory, scenario-based economic modelling approach that is more responsive to uncertainty and likely to result in more robust climate change response strategies. Van den Bergh (2004, p.385) proposes a qualitative approach to cost-benefit analysis that focuses 'attention on extreme events, structural change and complexity'. Other authors use alternative metrics, such as 'millions at risk' from climate change (Parry et al 2001). These alternative approaches offer valuable insights into the potential cost of climate change. I will consider their role in an integral policy development process in Chapter 8.

Economic models of climate change mitigation

The IPCC (2001b, p.489) identifies two basic modelling approaches for assessing the cost of climate change mitigation. The first uses a **top-down** or aggregate approach 'to assess the economy-wide and industry-specific impacts of policies to control' GHG emissions (Pezzey & Lambie 2001, p.xiii). Top-down models include macroeconomic models and computable general equilibrium (CGE) models. They use macroeconomic theory (especially neoclassical economic theory and general equilibrium theory) and aggregate economic variables to model the entire economy (IPCC 2001b, p.489). Most top-down models used in Australia are CGE models, including GTEM, developed by ABARE, G-Cubed, developed by the Australian National University and the University of Texas, and MMRF-Green, developed by Monash University (Pezzey & Lambie 2001).

CGE models are used to assess climate change mitigation policies or scenarios that 'directly or indirectly increase the relative price of GHG-intensive products and processes', such as carbon taxes or tradeable carbon permits (Pezzey & Lambie 2001, p.63). A major focus for CGE modelling in Australia has been estimation of the cost of Australian involvement in the Kyoto Protocol under varying assumptions about involvement by other countries, future commitments and the operation of emission trading regimes (e.g. ABARE 2002; Jakeman et al 2002; McKibbin 2002). The typical model output includes an estimate of the marginal cost per tonne of CO_2 abatement for the specified policy scenario and its impact on future economic activity (usually as a percentage change). It is important to note that CGE models cannot be used to assess the impact of 'non-price policies', such as education campaigns, labelling and standards and many regulatory actions (Pezzey & Lambie 2001).

The second type of modelling approach is **bottom-up** or disaggregated modelling. Bottom-up models include dynamic energy optimisation (partial equilibrium) models, integrated energy-system simulation models and partial forecasting models (IPCC 2001b, pp.488-489). These models analyse in detail the demand management or climate change mitigation potential of particular technologies and policies. An example of a bottom-up model used in Australia is the modified MARKAL model developed by ABARE and described by Naughten (2003). The MARKAL model selects from a database the least cost mix of demand and supply side technologies to meet an externally specified demand for energy. When the modeller imposes a constraint on GHG emissions, MARKAL will select the least cost abatement options within the energy sector (Diesendorf 1998). The results depend heavily on the quality of the database of energy technologies, particularly the assumptions made about the costs of different technologies and how those costs will change over time. MARKAL can model market constraints within the energy sector, but does not model the wider economic impacts of changes within the energy sector (Naughten 2003).

In practice, the distinction between top-down and bottom-up models is weakening, as most models are now hybrid constructions that model the entire economy but provide substantial detail on the structure and technologies of the energy sector (IPCC 2001b, p.489). Koopmans and Willem te Velde (2001) report on one such hybrid model.

Economic modelling issues and limitations

Both of the modelling approaches described above have limitations, pointed out in numerous critiques (e.g. Diesendorf 1998; Laitner, DeCanio & Peters 2000; Spash 2002; van den Bergh 2004). I have already noted that top-down models cannot evaluate non-price policies and that bottom-up models cannot evaluate economy-wide impacts. I will consider some other general and specific limitations of economic models, and other important issues that need to be considered in modelling, below.

Theoretical assumptions

Critiques of CGE models, in particular, focus on the neoclassical economic assumptions used in the models and the deviation of these assumptions from '*what people and organizations actually do*' (Laitner, DeCanio & Peters 2000, p.1).[29] As noted in Section 3.3.4, neoclassical economic theory assumes that people and firms are rational welfare-maximisers with fixed values and perfect information (IPCC 2001b, p.367). However, actual evidence (e.g. from energy efficiency programs) indicates that rationality is bounded, that individuals and firms adopt behavioural routines (habits) rather than continually optimising their behaviour, that information is contextual and unevenly distributed and that individual values are shaped by social, technological and cultural factors (IPCC 2001b, p.367; Laitner, DeCanio & Peters 2000, p.5; van den Bergh, Ferrer-i-Carbonell & Munda 2000).

Other theoretical criticisms listed by Laitner, DeCanio and Peters (2000) include poor treatment of technological change due to exclusion of increasing returns to scale, problems with the aggregation of mathematical representations of rational agents and a narrow approach to welfare that focuses on price and usually ignores distributional issues. In addition, evolutionary economists criticise neoclassical economic models, including CGE models, for their fixation on economic equilibrium and inability to adequately address disequilibrium dynamics (Mulder & van den Bergh 2001; Nelson & Winter 2002). Climate change response, like other sustainable development problems, requires 'major shifts in economic structure [that] involve uncertain and irreversible changes, selection of existing alternatives, learning, errors in decision-making, and a persistent economic disequilibrium' (Mulder & van den Bergh 2001, p.111). Modelling of non-marginal shifts and transition paths is not a strength of neoclassical equilibrium analysis (Mulder & van den Bergh 2001, p.112).

[29] Italics in original.

Market failure

One of the theoretical assumptions in most top-down economic models is that markets are perfectly efficient and competitive. In practice, due to the divergence of actual behaviour from economically rational behaviour, constraints on information available to market participants, regulatory intervention in markets, techno-institutional lock-in and the existence of externalities, markets for energy and energy-consuming goods do not usually operate efficiently and competitively (Brown 2001; Diesendorf 1998; Unruh 2000). In this case, **market failure** is said to occur or **market barriers** are said to exist (IEA 2003a). The IPCC (2001b, p.9) argues that: 'Reduction of existing market or institutional failures and other barriers that impede adoption of cost-effective emission reduction measures, can lower private costs compared to current practice'.

Market barriers have been well studied in Australia and internationally, particularly in relation to demand management (see CRA 2001; E2WG 2003; Greene & Pears 2003; IEA 2003a; IPART 2002b; NEMMCO 2002). Some examples of market barriers, drawn from these studies, are listed below:

- Existing energy services are simple, convenient and comprise a small proportion of total expenditure, so there is little incentive to consider more efficient options
- Prices are distorted by subsidies and failure to include positive and negative externalities
- Relevant information on energy efficiency options and feedback on energy use is not available to the right people at the right time
- Initial capital costs of energy-efficient options can be high, even though the life cycle cost may be lower than alternatives
- Financial incentives are often split between different parties
- End-users and utilities lack experience in undertaking demand management and do not have access to the necessary expertise or tools (fear of the unknown)
- Organisations appear to use a higher hurdle rate for energy efficiency investments than for other investments
- Retail energy businesses are high volume with low margins, and therefore have an incentive to sell as much energy as possible while also minimising marketing and transaction costs.

Many of these barriers can be overcome through appropriate market design, policy intervention or implementation of market instruments. Economic models that assume low rates of penetration for energy efficiency improvements underestimate the role of policy action in overcoming market barriers and may consequently overestimate the cost of climate change mitigation (Diesendorf 1998).

Exclusion of benefits

Economic analyses that estimate the cost of climate change mitigation often exclude some or all of the benefits of mitigation. I have already discussed the difficulties faced by those who wish to estimate the cost of climate change. Given these difficulties, it is unsurprising that most analyses do not attempt to include the benefits of climate change mitigation. More troubling is the common exclusion of ancillary benefits and co-benefits of climate change mitigation actions, which include increased employment, stimulation of innovation, regional investment, industry development and export potential, energy security improvements and other environmental and health benefits (Diesendorf 1998; Elliott 2000; Hamilton, Pears & Pollard 2001; IPCC 2001b; MacGill, Watt & Passey 2002, p.463).

The IPCC (2001b, p.11) notes that identification of ancillary benefits is difficult: 'In general, it is easier to identify activities, which stand to suffer economic costs compared to those which may benefit, and the economic costs are more immediate, more concentrated and more certain'. Thus it is clear that the coal industry faces significant costs in responding to climate change, but unclear which alternative industries will grow in response to the opportunities presented by climate change response. Despite these difficulties, when the results from cost assessments are presented without adequate discussion of climate change avoidance and ancillary benefits, as is often the case,[30] there is a risk that public understanding of the true cost of responding to climate change will be distorted.

Discounting the future

The benefits, and to a lesser extent the costs, of climate change mitigation accrue far into the future. Standard economic modelling practice is to use a constant discount rate to convert this stream of future costs and benefits into a net present value. The theoretical justification for discounting is the higher value placed on a given sum that is available in the present, relative to the same sum that is available in the future. The rationale is that a sum available in the present can be invested at the prevailing rate of return and will therefore be worth more in the future. Some authors argue that 'the special characteristics of the global warming problem like the very long time horizons, the possibility of irreversible changes, [and] the threat of potential climate catastrophes' justify the use of a discount rate that differs from standard practice (Tóth 2000, p.127). Standard discounting makes any damages in the distant future appear very small today (IPCC 2001b, p.466), biasing assessments towards the needs of present generations and violating the rights of future generations (Spash 1994).

[30] An example is the presentation by the Australian Greenhouse Office of modelling results on the economic impact of the Kyoto Protocol (see http://www.greenhouse.gov.au/international/kyoto/index.html #modelling). The reader is left with the false impression that involvement in the Kyoto Protocol has costs but no benefits.

According to Tóth (2000, p.134), there are three positions on the appropriate discount rate for use in cost-benefit analysis of climate change mitigation. The first position is that the discount rate and discounting technique should be unchanged from that used for any public policy issue. According to Newell and Pizer (2004), conventional market discount rates lie between 2 and 7 per cent. The second position is to advocate the use of lower discount rates (or rates that decline over time) to bring long-term climate change impacts on future generations to the attention of policy makers. This is the approach adopted by the IPCC, which employs the equivalent of a 0.9 per cent annual discount rate in its calculation of the global warming potential of different GHGs (Fearnside 2002). Neither of these positions addresses uncertainty in the future discount rate, which becomes particularly relevant as the timeframe considered extends beyond about 30 years (Newell & Pizer 2004). The third position, which I prefer, argues that:

> …if there are hard to value assets or highly valued environmental components at risk and/or the inertia of the underlying bio-geophysical system is such that there is a severe danger of going beyond a point-of-no-return [then] the cost-benefit argument has only limited validity. The best and economically most efficient strategy in this case is to define long-term environmental goals and work out the optimal cost-effective policy to reach them (Tóth 2000, p.134).

That is, economic analysis should not be used to determine whether or not to respond to climate change; this is properly a political and ethical decision. The role of economic analysis is to identify cost-effective policies to achieve environmental objectives established through a political process. Once political targets have been established, taking into account the rights of future generations, it is appropriate to use the standard market discount rate to identify preferred policies to achieve those targets. I will return to this point in Chapter 8.

Presentation of modelling results

Economic models are characterised by a high degree of complexity and a large number of assumptions. In many cases, the modelling assumptions are not clearly stated and little information about the operation of the model is available (Diesendorf 1998). Failure to outline the limitations of economic models encourages uncritical acceptance of their results as predictive rather than indicative. As Laitner, DeCanio and Peters (2000, p.49) point out: 'Over-reliance on the predictive power of even well specified equilibrium models leads to a specious precision that can mislead those who are unaware of the limitations of the models'. Henman (2002, p.161) examines the interactions between computer models and greenhouse policy in Australia and argues that their complexity and typical presentation 'constrains the capacity for the conduct of democratic politics'. The lack of transparency in model assumptions makes it difficult to publicly contest model results and facilitates the use of models to construct partisan political views (Henman 2002; Laitner, DeCanio & Peters 2000).

3.7.3 Economics of mitigation options

Bearing in mind the limitations discussed in the previous section, economic analysis can offer important insights into the appropriate mix of technology and policy options for climate change response. For convenience, I treat the economics of demand side and supply side options separately below.

Economics of demand side options

As discussed in Section 3.5.2, demand side or demand management options are those that reduce overall or peak energy demand through energy service reduction, energy efficiency improvement, distributed generation and other measures. There is substantial evidence from bottom-up economic models and empirical studies that cost-effective opportunities exist to reduce energy demand at the levels of the household, organisation and nation (e.g. Allen Consulting 2003; EMET 2004a, 2004b; Energetics 2004; IPCC 2001b, Chapter 3). Internationally, the IPCC (2001b, p.260) identifies potential GHG emission reductions, relative to its baseline *B2-Message* scenario, of 14 to 23 per cent by 2010 and 23 to 42 per cent by 2020. Approximately half of the potential emission reductions to 2020 are possible at a negative net cost, mostly through improvements in energy efficiency. The remaining half are available at approximate costs of up to \$A40/t CO_2-e (IPCC 2001b, p.260).

In Australia, the Energy Efficiency and Greenhouse Working Group (E2G2) established by the Ministerial Council on Energy (MCE) found that 'energy consumption in the manufacturing, commercial and residential sectors could be reduced by 20–30% with the adoption of current commercially available technologies with an average payback of four years' (E2WG 2003, p.6). If the payback period is increased to eight years, the commercial potential increases to 70 per cent in the residential and commercial sectors and 40 to 50 per cent in other end use sectors (E2WG 2003). Under a conservative scenario in which 50 per cent of the commercial potential with a payback of four years was adopted over a 12-year period, E2G2 found that real GDP and employment would increase, while GHG emissions from the stationary energy sector would fall by 9 per cent relative to a **business as usual** scenario in which existing trends continue into the future (E2WG 2003).

Demand management tends to be a commercially attractive GHG abatement option because it offers ancillary benefits, in terms of reduced energy bills and avoided cost of energy supply, that offset its implementation cost. However, despite the apparent cost-effectiveness of demand management, the uptake of demand management options has been slow (E2WG 2003; Greene & Pears 2003). Neoclassical economists argue that this slow uptake reveals the existence of transaction costs, such as the cost of obtaining information about demand management, that are not considered in bottom-up economic assessments of demand management options; in an efficient and competitive market, all truly cost-effective opportunities for demand management would already have been taken up.

An alternative argument, discussed in Section 3.7.2, is that market failure creates barriers to the uptake of cost-effective demand management options. This argument is convincing, given the empirical evidence that significant energy-saving opportunities are available when appropriate policy action is taken (see, for example, the case studies in E2WG 2003). As one example, Newcastle City Council (NCC) has achieved a cumulative saving of $1.7 million on its electricity bill through a one-off investment of $1 million (NCC 2002). Policy makers in Australia are working to identify and remove institutional and market barriers to demand management so that these cost-effective GHG abatement measures can be fully captured (e.g. E2WG 2003; IPART 2002b).

Economics of supply side options

Australia's primary fuel mix, outlined in Section 3.5.1, is explained by the relative cost of different energy sources. For example, in the National Electricity Market (NEM) that serves the eastern states of Australia, the lowest-cost electricity is provided by coal-fired power stations with a marginal generation cost of about $35 to $40/MWh (COAG 2002; Saddler, Diesendorf & Denniss 2004). These power stations dominate electricity generation in Australia. The cost of electricity from natural gas power stations has fallen in recent times to about $40/MWh (COAG 2002). Consequently, natural gas-fired power stations are steadily increasing their share of electricity generation. Given that the cost of electricity from a natural gas-fired power station is comparable to that from a coal-fired power station, substitution of natural gas for coal in electricity generation is currently the most economically attractive supply side option for climate change response.

Electricity from renewable sources is commercially competitive with fossil fuel energy in particular circumstances. Specifically, hydroelectricity from existing large dams competes favourably with fossil fuels and biomass energy is cost-competitive in situations where a low-cost feedstock is available, such as waste bagasse in the sugar industry. Consequently, hydroelectricity and biomass energy are responsible for most of the existing renewable energy use in Australia. Other renewable energy sources are competitive in niche applications. For example, wind and solar power are attractive options in remote locations that are not linked to the electricity grid, as an alternative to diesel generators or grid extension. Beyond these applications, renewable energy currently requires regulatory support to successfully compete with fossil fuels in mainstream applications. Without such support, wind power in Australia costs between $75 and $90/MWh and electricity generated from solar energy costs at least $200/MWh (Saddler, Diesendorf & Denniss 2004).

There are several reasons for the cost differential between fossil fuels and renewable energy. Fossil fuels have some important natural advantages, in terms of energy density and mobility, that are reflected in pricing. Coal, oil and natural gas are concentrated sources of energy that are relatively easy to collect, transport and utilise, whereas renewable energy sources are diffuse and, in some cases, require advanced technologies to capture and store (Hoffert et al 2002).

Other reasons for the cost differential are unrelated to any inherent superiority of fossil fuels and have more to do with historical path-dependent processes in the energy system. First, the energy market is distorted by government subsidies to both fossil fuels and renewable energy (de Moor 2001; OECD 2003). To the extent that fossil fuels receive a greater share of these subsidies than renewable energy, the prices of fossil fuels will be artificially lowered with respect to renewable energy. That is, subsidisation will increase the price differential between fossil fuels and renewable energy beyond what the market would determine on its own. The relative magnitude of subsidies to fossil fuels and renewable energy in Australia is uncertain. I address this gap in the literature in Chapter 6.

Second, most of the existing fossil fuel-based energy infrastructure was built by state-owned utilities, before energy market deregulation. Consequently, over time, fossil fuel technologies have benefited from a massive amount of government investment. This investment generated economies of scale that helped to reduce costs and tended to lock in fossil fuel infrastructure (Elliott 2000; Unruh 2000). It is unreasonable to expect renewable energy to be cost competitive with an established technology that has received far more public funding over time. A strong case can therefore be made for public investment in renewable energy in keeping with previous support for fossil fuels.

Third, the energy costs discussed above do not include various positive and negative externalities. The main externality for fossil fuel consumption is the cost of future climate change. For renewable energy sources, as noted in Section 3.7.2, ancillary benefits such as regional employment and the development of new export industries are often neglected. If these costs and benefits were included, it is likely that renewable energy sources would be competitive with fossil fuels.

It is clear, then, that it is primarily the history and institutional structure of the energy system, rather than any inherent superiority of fossil fuels, that creates the evident economic advantage of fossil fuels over renewable energy. This economic advantage is gradually diminishing; the costs of renewable energy are falling rapidly as experience with the technologies increases, whereas the costs of fossil fuels are relatively stable (IEA 2000).

3.7.4 Market instruments for climate change mitigation

The final category of economic literature on climate change concerns market instruments for climate change mitigation. As discussed in Sections 3.7.2 and 3.7.3, market failure and market barriers are implicated in the slow uptake of some promising climate change mitigation options. Further, the existing cost differential between fossil fuel and renewable energy sources is at least partly due to the exclusion from markets of negative externalities associated with fossil fuel combustion, particularly the cost of climate change. Market theorists have proposed numerous modifications to market design, including creation of new markets, to address these issues. The main types of market-based instrument for climate change mitigation are emissions taxes and charges, tradable permits and subsidies.

An emissions tax requires GHG emitters to pay a fixed tax per tonne of GHG emitted (IPCC 2001b, p.413). The tax is a way of including some of the externalities associated with fossil fuel combustion in the price of fossil fuels. It encourages GHG emitters to adopt abatement measures that cost less to implement than the cost of paying the tax. The imposition of an emissions tax does not guarantee a particular level of emission reduction, as emitters may choose to pay the tax rather than pursue abatement options (IPCC 2001b, p.413). Australia has not implemented any taxes specifically aimed at reducing GHG emissions to date.

A tradable emission permit system is another way to include some of the externalities associated with fossil fuel combustion in the price of fossil fuels, while also capping total GHG emissions. Upon commencement of a tradable permit system, emission permits equal to the emissions limit are distributed, either free of charge or through an auction. An emitter must subsequently hold permits equal to its total GHG emissions. As permits are tradable, emitters that are able to achieve GHG abatement at a cost below the market price for emission permits can sell their permits to other emitters that cannot so readily reduce their emissions. This is intended to ensure economic efficiency. As long as the number of permits is reduced over time, an emissions trading approach can be an effective means of facilitating GHG abatement. Australia has not implemented a comprehensive national tradable permit system for GHG abatement. However, limited tradable permit schemes have been implemented to monitor compliance with the Australia-wide Mandatory Renewable Energy Target (MRET) and the NSW Greenhouse Gas Abatement Scheme benchmark targets. I will discuss these schemes in Section 3.8.2.

Subsidies have a similar impact to emission taxes, except that a payment is made to those who provide GHG abatement rather than imposing a penalty on those who emit GHGs. The payment lowers the cost of GHG abatement technologies, allowing them to compete more readily with conventional technologies. Subsidies may be provided for research, development and deployment, for market transformation or for removal of market barriers (IEA 2003a). Australia has implemented numerous subsidies for GHG abatement and renewable energy development; I will discuss these in more detail in Chapter 6.

3.8 Social and political institutions and climate change

In this section, I consider social and political institutions that are relevant to energy policy and climate change response. I take my definition of an **institution** from Connor and Dovers (2004); their work is particularly relevant for its explicit focus on sustainable development and its Australian origin. Institutions are durable patterns of social rules and constraints that shape human behaviour and interaction. They include:

> …all socially devised rules of governance such as articles of constitutions, statute and common law, regulations and by-laws, policies, legal rulings, contracts, codes of conduct and honour, and the myriad of social and cultural traditions and norms that constrain the way individuals and groups act in social contexts (Connor & Dovers 2004, p.11).

From an integral perspective, I equate institutions with the exterior forms and patterns of collective social and political systems.

The terms institution and **organisation** are often used interchangeably, but from the above definition, it is clear that most institutions are not organisations. Indeed, Connor and Dovers (2004, pp.10-14) discuss a conceptual distinction in which organisations arise in response to pre-existing institutional rules, giving institutions analytical priority. However, this distinction tends to be blurred in practice and I consider both durable institutional rules and transient organisations here.

Around the world, existing institutions and organisations are attempting to adapt to the challenges posed by climate change, and new institutions and organisations are arising as part of the global response. I consider international political institutions, including analysis and criticism of those institutions, in Section 3.8.1. In Section 3.8.2, I describe the institutions and organisations that comprise the energy and climate policy networks in Australia. In Section 3.8.3, I review literature on the institutional and political changes required for an effective response to climate change. Finally, in Section 3.8.4, I consider literature that adopts a social autopoietic perspective on climate change.

3.8.1 International political institutions for climate change response

This section discusses the international political institutions that have emerged in response to the threat of climate change, coordinated by the United Nations. These institutions include the Framework Convention on Climate Change (FCCC) and the Kyoto Protocol (KP) and their associated rules and conferences. There are, of course, many other international institutions and organisations that influence the global response to climate change. For example, the IPCC is an institution that acts as an interface between science and policy. The International Energy Agency is an institution that provides primary data on global energy use and helps to set the policy agenda for the energy sector. Other organisations, such as the Climate Action Network, have helped to institutionalise lobbying and non-government organisation (NGO) involvement in political negotiations. Despite the importance of these international institutions and organisations, I am interested for this thesis in the coordinating political institutions that act as an interface between Australian and international policy.

The Framework Convention on Climate Change

In December 1990, influenced by the findings of the IPCC's FAR (Agrawala 1998, p.633), the United Nations General Assembly began negotiations towards the Framework Convention on Climate Change. The FCCC (United Nations 1992b) was adopted by the UN in May 1992, opened for signatures at the Rio Earth Summit in June 1992, and entered into force in March 1994. Its ultimate objective is:

> …stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner (United Nations 1992b, Article 2).

The FCCC does not define the type of interference with the climate system that might prove dangerous, nor does it establish a target atmospheric concentration for GHGs. It includes no binding targets or commitments to reduce GHG emissions to a particular level.

As of September 2004, 189 Parties[31] had ratified the FCCC, including Australia. There have been nine annual Conferences of the Parties (COPs) to the FCCC, at which the parties have sought to identify and negotiate a political process for achieving the ultimate objective of atmospheric stabilisation. The First COP (COP-1) in Berlin resulted in the *Berlin Mandate*, calling for the 'strengthening of the commitments of the Parties included in Annex I…through the adoption of a protocol or another legal instrument', containing GHG limitation and reduction targets, by COP-3 (United Nations 1995, p.4). The Mandate stated that the 'developed country Parties should take the lead in combating climate change and the adverse effects thereof' (United Nations 1995, p.4).

The Kyoto Protocol

At COP-3, held in December 1997 in Kyoto, Japan, the Parties adopted the Kyoto Protocol to the FCCC (United Nations 1997). The KP applies to six GHGs: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (HF_6). The aim of the KP is to reduce GHG emissions from Annex B Parties[32] to 'at least 5 per cent below 1990 levels in the commitment period 2008 to 2012' (United Nations 1997, Article 3.1). To achieve this aim, the KP includes differentiated, legally binding targets for each of the Annex B Parties.

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[31] Parties are those States or Economic Organisations (in the case of the European Economic Community) that have ratified the FCCC. Annex I Parties are the industrialised countries, including Australia, listed in Annex I of the FCCC.

[32] The Annex B Parties include all the countries in Annex I, with the exception of Belarus, Croatia and Turkey.

Negotiations over the rules and guidelines for implementing the KP commenced in 1998 at COP-4 and were successfully concluded in November 2001 at COP-7, held in Marrakesh, Morocco. The decisions adopted at COP-7 established the final rules for implementation of the KP and are collectively known as the *Marrakesh Accords* (United Nations 2002a).

As of November 2004, 84 Parties had signed, and 128 Parties had ratified, accepted, approved, or acceded to the KP. Ratification by at least 55 Parties to the Convention, accounting for at least 55 per cent of the total 1990 carbon dioxide emissions from all Annex B Parties, was set as a condition for the KP to become legally binding on Parties. This condition was met on 18 November 2004 when the Russian Federation deposited its ratification with the United Nations. The KP will now enter into force on 16 February 2005. Only four Annex B parties have not ratified the KP: Australia, Liechtenstein, Monaco and the United States (US).

Analysis of international climate policy frameworks

There is no shortage of literature analysing international climate policy frameworks. Indeed, there are entire journals devoted to analysis of this type (e.g. *Climate Policy*, published by Elsevier). Much of the literature assesses the effectiveness of the KP and its specific implementation rules (e.g. den Elzen & de Moor 2002; Michaelowa et al 2003; Ott 2001) or considers alternative policy architectures (e.g. Aldy, Barrett & Stavins 2003; Lisowski 2002). I will not attempt a comprehensive review of this literature here, as my main purpose in this chapter is to identify existing work covering the developmental lines in the objective quadrants, and it is clear that the development of international policy frameworks is well covered.

I will, however, note some important points to emerge from the international climate policy literature. First, the inclusion of developing countries in the international response to climate change is recognised as one of the key issues for future climate policy negotiations (Berk & den Elzen 2001; Najam, Huq & Sokona 2003). Under existing trends, Jakeman et al. (2002) forecast that non-Annex B emissions will overtake Annex B emissions by 2010. Eventual stabilisation of the climate system will inevitably require participation, in some form, by the non-Annex B Parties. The nature of that participation raises important ethical issues that I will consider in Chapter 4.

Second, the KP fails to mandate emission reductions of the magnitude required to stabilise the climate. The KP started with a modest initial target of an average five per cent reduction in 1990 Annex B Party emissions by the first commitment period (2008 to 2012). Its environmental effectiveness has since been weakened by the withdrawal of the United States and Australia and the use of 'defensive diplomacy' to insert and widen loopholes (Spash 2002, p.15). As a result, climate policy analysts estimate that it will achieve a real reduction in GHG emissions of about half a per cent for those Annex B Parties that ratify the KP (den Elzen & de Moor 2002). Assuming that the US, Australia and developing countries continue to increase their GHG emissions through to 2010, it is unlikely that global GHG emissions will fall at all as a result of the KP.

Given that the KP does not, in itself, achieve long-term environmental objectives, policy makers are divided about its value. Some, including the Australian and US Governments, argue that the KP is deeply flawed and should be abandoned in favour of an international policy framework that includes all nation-states (e.g. DPMC 2004, p.24; United States Government 2002). Others argue that the KP provides a valuable institutional framework for further international action and cooperation in the future (e.g. Grubb & Depledge 2001), albeit a framework in need of revision (Lisowski 2002). The recent Russian ratification of the KP means that the immediate focus of the international community will be to gain experience with the various implementation and trading mechanisms included under the KP. Attention will now turn to the structure of future frameworks for the period after 2012.

Third, there is a strong focus in the international climate policy literature on the need to integrate climate change response with sustainable development (e.g. Beg et al 2002; Cohen et al 1998; Michaelis 2003; Najam et al 2003; Robinson & Herbert 2001; Swart, Robinson & Cohen 2003). That is, the international response to climate change must consider not only the need to reduce GHG emissions but also issues of equity and the rights of those in developing countries to economic development and higher living standards. The IPCC began to respond to this push for integration in its TAR, by reviewing mitigation options within a broader context of development, equity and sustainability (IPCC 2001b, pp.77-78). The argument for integration of development concerns with climate change response is ultimately a moral and ethical argument; I will consider it in more detail in Chapter 4.

3.8.2 Australian institutions and climate change

In this section, I discuss Australian institutions and organisations that are relevant to energy policy and climate change response. I start with a brief review of existing policy and institutional analysis work in this area. I do not consider critiques of Australian policy in detail here; Chapter 5 reports on a critical review of Australian energy and climate policy.

Policy and institutional analysis in Australia

There is a substantial domestic literature that reviews, analyses and critiques the *content* of Australia's existing energy and greenhouse policy (e.g. Hamilton 2001; Hamilton & Vellen 1999; MacGill, Outhred & Nolles 2003; Pollard 2003). I will consider the content of Australia's energy and greenhouse policy in more detail in Chapter 5. Here, I am more interested in literature that analyses the policy *processes* and *institutions* that have developed around energy and climate change issues. Bulkeley's work on the Australian climate policy network (Bulkeley 2000b) and on the evolution of policy principles in Australia (Bulkeley 2001) is an excellent example of institutional analysis in a domestic context.

Bulkeley (2000b, p.727) applies the political science concept of a **policy network** to capture 'the dynamic and complex relations between actors at a variety of scales'. Policy networks 'provide structured social relations and rules, which enable and constrain policy change, through allowing some actors, and some ideas, into the policy process while excluding others' (Bulkeley 2000b, p.744). In other words, a policy network is an institutional structure that forms around a particular policy issue, such as energy or climate change.

Policy network approaches can be positivist or constructivist, either assuming that the policy network structures individual beliefs and interests, or that the individual constructs the network according to his or her beliefs and interests (Rhodes 2002, p.400). Bulkeley (2000b) adopts a constructivist perspective, using the idea of discourse coalitions to emphasise the interpretative and argumentative nature of policy development within policy networks. As the concept of discourse coalitions introduces a subjective perspective, I will discuss the coalitions identified by Bulkeley in Chapter 4. Here, I will use the policy network concept to structure a description of the Australian energy policy and climate policy networks, the latter updating Bulkeley's earlier work.

The Australian energy policy network

Jurisdiction over energy policy in Australia is shared between the Commonwealth[33], State and Territory governments and coordinated through the Council of Australian Governments (COAG). In June 2001, COAG established the Ministerial Council on Energy (MCE) to provide national energy policy leadership. Its membership comprises Ministers with responsibility for energy from Commonwealth, State and Territory governments, supported by a Standing Committee of Officials (SCO) and several working groups. Its primary objective is:

> …to produce policies which will maximise the provision of reliable energy services and drive an open and competitive energy market while delivering benefits within a sustainable development framework and meeting expectations of social responsibility and responsiveness to consumers (MCE 2001, p.1).

At the same time, COAG established the Ministerial Council on Mineral and Petroleum Resources (MCMPR) to promote sustainable development of the Australian mining, minerals and petroleum industry. Its membership is similar to the MCE, comprising Ministers with responsibility for minerals and petroleum from Commonwealth, State and Territory governments.

A policy statement released by the Commonwealth Department of Prime Minister and Cabinet (DPMC) in June 2004 provides national policy direction in the energy sector (DPMC 2004). An important part of this policy is the establishment, overseen by the MCE, of an Australian Energy Regulator (AER) and Australian Energy Market Commission (AEMC) to consolidate and simplify existing regulatory arrangements in the energy sector (MCE 2004b).

[33] The Commonwealth Government is Australia's national government, also referred to as the Federal Government or Australian Government. I use these three labels interchangeably in this thesis.

The need for consolidation and simplification of existing regulatory arrangements is readily apparent from a brief consideration of regulation of electricity supplied through the National Electricity Market, which serves Queensland, NSW, Victoria and South Australia and, from 2005, Tasmania. The rules for the National Electricity Market are set out in a National Electricity Code (NEC), enforced by the National Electricity Code Authority (NECA). The NEM is managed by the National Electricity Market Management Company (NEMMCO), which also has some limited regulatory powers. Participants in the NEM are subject to regulation by independent regulatory authorities in each state, such as the Independent Pricing and Regulatory Tribunal (IPART) in NSW and the Essential Services Commission (ESC) in Victoria, which each establish their own regulations, codes and guidelines. Further, State government departments with responsibility for energy, such as the Department of Energy, Utilities and Sustainability (DEUS) in NSW, establish various regulatory requirements and policy directions that market participants need to comply with. In addition, electricity transmission businesses are subject to regulation by the Australian Competition and Consumer Commission (ACCC). This regulatory complexity and duplication is typical of the Australian energy sector.

Participants in the energy policy network include energy retail businesses, energy generation businesses, transmission network service providers (TNSPs), distribution network service providers (DNSPs), large and small customers and the numerous regulatory authorities and government departments discussed above. The policy network also includes industry associations (e.g. the Energy Supply Association of Australia, ESAA, and the Business Council for Sustainable Energy, BCSE), environmental lobby groups (e.g. the Climate Action Network Australia, CANA), scientific and economic advisors (e.g. CSIRO and ABARE) and consumer advocacy groups (e.g. the Public Interest Advocacy Centre, PIAC).

The Australian climate policy network

All of the actors involved in the Australian energy policy network are also involved, directly or indirectly, in the climate policy network. However, there are additional actors and institutions that deal primarily with climate policy. At the national level, the Australian Greenhouse Office coordinates domestic climate change policy and delivers a diverse range of climate change response programs, including competitive grants schemes (e.g. the Greenhouse Gas Abatement Program, GGAP), community support programs (e.g. Cool Communities), voluntary initiatives (e.g. the Greenhouse Challenge for industry) and regulation (e.g. Minimum Energy Performance Standards for appliances and equipment).

Also at the national level, the Commonwealth government has established a Mandatory Renewable Energy Target for electricity generation to limit growth in GHG emissions from this sector and to promote industry development. The MRET is implemented through the *Renewable Energy (Electricity) Act 2000* and associated legislation and regulations, and administered by the Office of the

Renewable Energy Regulator (ORER). The original aim of the MRET was to increase the proportion of renewable energy in Australia's electricity generation by two per cent, from nine per cent to eleven per cent, by 2010. However, the final legislated target was for an absolute increase in renewable generation of 9,500 GWh per year over a defined baseline in 2010. Due mainly to faster than expected growth in total electricity generation, the MRET is currently expected to increase the total share of renewable electricity generation by only 0.5 per cent in 2010 (AEA 2001).

Several Commonwealth government departments have an interest in the nature of Australia's climate change response. The Department for Environment and Heritage (DEH) is concerned with the environmental effectiveness of the response, the Department of Industry, Tourism and Resources (DITR) is concerned with the industry impacts and opportunities and the Department of Foreign Affairs and Trade (DFAT) is concerned with international treaty negotiations. State governments have also established departments or authorities dedicated to climate change response, including the NSW Greenhouse Office and the Sustainable Energy Authority Victoria (SEAV). In addition, the Australian climate policy network includes numerous businesses, interest groups, scientific organisations and academics.

3.8.3 Institutional change for climate change response

The discussion in Sections 3.8.1 and 3.8.2 indicates that existing institutions are changing and new institutions have emerged in response to climate change. In this section, I review literature that examines processes of institutional change and lock-in, or proposes new institutional designs to better respond to climate change.

The institutional perspective on climate change

An institutional perspective on the problem of climate change response offers certain insights that are not necessarily evident when focusing on the technical feasibility and cost-effectiveness of climate change mitigation technologies. For example, the most common argument against stronger or faster climate change mitigation is the harmful impact that such action would have on economic growth. I argued in Section 3.7.3 that the apparent economic advantage of fossil fuel energy over low-emission alternatives is more an artefact of the current design of the economic system than a reflection of any natural advantage of fossil fuels. An institutional perspective encourages one to step outside the constraints of existing systems, identify the rules governing their operation and reflect on how those rules might be changed to achieve desirable outcomes. It is founded on recognition that 'however objectivated, the social world was made by men [sic] – and therefore can be re-made by them' (Berger & Luckman 1966, p.106). Thus, from an institutional perspective, the economy is recognised as a social tool designed by humans for allocation of scarce resources. The current failure of this tool to select low-carbon technologies over carbon-intensive technologies can then be understood as an institutional design problem.

Of course, redefining climate change response as an institutional design problem does not, necessarily, make climate change mitigation any easier. Rather, this redefinition reveals that it is not only fossil fuel technologies that have become locked in, as described in Section 3.5.4, but also the institutions that support or are supported by those technologies (Unruh 2000). Many existing institutions, including market economies, arose during a period when climate change was not anticipated and constraints on GHG emissions were not necessary. In fact, in the energy sector, many institutions arose specifically to facilitate rapid deployment of energy technologies to meet growth in energy demand after the Second World War (Robinson 2003; Unruh 2000). These institutions act to support the existing energy system and are not well adapted to the new challenges posed by climate change. Elliot (2000) gives the example of financing arrangements in the energy sector, which are often geared towards large-scale centralised energy infrastructure. Demand management and renewable energy technologies are typically smaller scale and distributed, so proponents find it difficult to access finance.[34]

The main advantage of an institutional perspective is that it allows policy makers to move beyond interminable, and irresolvable, debates over the relative costs of climate change and climate change mitigation. If costs are very uncertain, and are largely a function of institutional design, then it is more fruitful to focus on the redesign of institutions to support climate change response. This focus is consistent with Elliot's (2000, p.264) argument that a prerequisite for successful deployment of low-carbon technologies and financial incentives for climate change mitigation is close attention to the adequacy of social and institutional support for those options.

Principles for institutional change

If institutional change is an important objective for climate change response, then it is useful to develop an understanding of how institutional change might occur and what type of changes should be pursued. Several authors have addressed these issues, either from the general perspective of institutional change for sustainable development (e.g. Connor & Dovers 2004; Robèrt et al 2002) or the specific perspective of institutional change for climate change response (e.g. Elliott 2000; Unruh 2002). I will consider both these perspectives below.

Connor and Dovers (2004) use detailed case studies to develop seven principles of institutional change for sustainable development. These principles deal with both objective and subjective change. I will focus here on the principles that deal with objective change and consider the remaining principles in Chapter 4. I also draw on the process principles proposed by Robèrt et al (2002) where appropriate.

[34] Utilities contemplating demand management or installation of renewable energy must deal with many such institutional barriers and uncertainties. These increase the risk of pursuing sustainable energy options. In a recent decision to augment electricity supply rather than pursue a more cost-effective demand management strategy, TransGrid and Energy Australia (2000, p.68) argued that demand reductions of the magnitude required had 'not been attempted in Australia before…[and] adopting this option would lead to an unreasonable level of risk'.

One of the principles outlined by Connor and Dovers (2004, pp.214-215) notes the importance of international law and policy as drivers of institutional change at other scales of governance. In the case of climate policy, this principle is a reminder of the crucial importance of the international climate policy frameworks discussed in Section 3.8.1. Domestic climate policy cannot be considered in isolation from global policy. Robèrt et al (2002, pp.203-204) also emphasise the importance of international agreements, drawing attention not only to the need for specific environmental agreements but also to the need to ensure that international trade agreements are consistent with environmental objectives.

Another of the principles listed by Connor and Dovers (2004, pp.212-214) emphasises legal change, noting the importance of statutory law as a way of codifying institutional systems. Similarly, Robèrt et al (2002, p.204) emphasise the need for legislation to protect the global commons. For the domestic response to climate change, these principles encourage legislation of a long-term GHG reduction target or emissions trading system to provide certainty for investors. Embedding policies in legislation is a good way to give them sufficient longevity to become institutionalised.

Referring to governance structures, Connor and Dovers (2004, p.219) recommend the principle of subsidiarity, which states that 'in a hierarchical democratic governance system…a decision should be taken at the level at which it can be most effective'. Applied to climate policy, this means that the decision to address the global problem of climate change would appropriately be reached in a global governance forum (e.g. the United Nations), as would any allocation of responsibility for action across nation states. Each nation-state would be free to decide how it should meet its obligations. National governments would provide leadership, funding and policy guidance for the practical action of climate change mitigation, that would take place largely at the level of regional (e.g. state) and local governments.

Finally, Connor and Dovers (2004, p.221) outline a principle of reiteration, recognising that uncertainty, shifting values, and the long-term nature of sustainable development (and climate change response) 'dictate periodic reassessment, adjustment and recommitment to principles, policies and actions as a prudent strategy'. That is, policy development needs to be understood as an evolutionary process. I will return to this point in Chapter 8.

Unruh (2002) and Elliot (2000) consider institutional change in the context of energy policy and climate change response. Elliot (2000) argues that institutional modifications require strong political will, driven by an informed citizenry willing to move away from high-consumption lifestyles. I will consider ways to promote these pre-conditions for institutional change in Chapter 4. Given the reality of carbon lock-in, Unruh (2002) is quite pessimistic about the possibility of institutional change. He identifies three possible policy responses to move away from lock-in of a techno-institutional complex based on fossil fuels but is dismissive when considering their feasibility and prospects. I will consider his three responses below.

The first response proposed by Unruh (2002, p.323) is niche development of alternative technologies to reduce their cost:

> The hope of these niche approaches is that the technologies become "cost effective" before irreversible climate damage is done. The problem, of course, is that "cost effective" is not an objective criterion, but depends on the incentives and disincentives established by the institutions within the TIC, which currently foster the continued expansion of carbon-based energy systems.

Unruh argues that incremental change of this type is insufficient to break TIC lock-in. I tend to agree; GHG emission reductions of the magnitude required to stabilise the climate require trend-breaking changes in institutional structures.

Unruh (2002, p.323) also raises the possibility that public education campaigns and scientific research could establish a social consensus to pursue institutional change for climate change mitigation. However, he argues that the effectiveness of public education campaigns is limited by the complexity of climate change, promotion of uncertainty by vested interests and the inability of the news media to accurately represent policy issues. While I agree that the establishment of a social consensus will be difficult, I believe it offers one of the best hopes for an effective global response to climate change. Consequently, as I argue throughout this thesis, greater attention to the subjective processes of development required to establish such a consensus is crucial. I will return to this topic in Chapter 4.

Finally, Unruh (2002, p.323) concludes that 'policy makers may have to wait for a focusing event, such as a recognized climate crisis, before implementing new policy frameworks'. Given the potentially catastrophic human and environmental impacts of such a crisis, Unruh's pessimistic appraisal is particularly unpalatable for anyone seeking to avert the worst impacts of climate change. In the next section, I review policy development processes and tools used in the energy sector, some of which can potentially facilitate a more positive response to institutional lock-in. In particular, normative approaches to energy sector planning seem to offer a pathway to escape from carbon lock-in.

3.8.4 Social autopoiesis

Social autopoiesis is identified in Figure 2.3 as one of the two major methodological approaches for addressing the systemic quadrant. I believe that the literature on technological and institutional lock-in, reviewed in Sections 3.5.4 and 3.8.3, adopts a social autopoietic perspective by considering self-regulation of technological and institutional systems. The insights that are summarised in the notion of lock-in arise by adopting a perspective within collective technological and institutional systems and examining the actual experiences of those systems.

Another body of theory with relevance to climate change that adopts a social autopoietic perspective is the Gaia theory, advanced by Lovelock (1987; 1988). This theory states that 'the system of the material Earth and the living organisms on it…[evolves] so that self-regulation is an emergent property' (Lovelock 1988, pp.19-20). By extension, the co-evolving physiosphere and biosphere have maintained an atmospheric composition suitable for the existence of life for several billion years. Anthropogenic GHG emissions may interfere with the processes of atmospheric self-regulation in uncertain ways. The climate models discussed in Section 3.6.2 are an attempt to understand the self-regulating dynamics of the atmospheric system.

As noted in Section 3.1, I will not present the conclusions of my literature review here. Rather, I will present the conclusions at the end of Chapter 4, after my review of literature that adopts a subjective perspective on energy and climate change.

4. Subjective and Integrative Perspectives on Energy and Climate Change

> The tree which moves some to tears of joy is in the eyes of others only a green thing that stands in the way. Some see nature all ridicule and deformity…and some scarce see nature at all. But to the eyes of the man of imagination, nature is imagination itself.
>
> - William Blake

> A society's values are the basis upon which all else is built. These values and the ways they are expressed are a society's culture. The way a society governs itself cannot be fully democratic without there being clear avenues for the expression of community values, and unless these expressions directly affect the directions society takes. These processes are culture at work.
>
> - Jon Hawkes, *The Fourth Pillar of Sustainability*, p.vii

4.1 Introduction

In Chapter 3, I reviewed literature that adopts a behavioural or systemic perspective on energy and climate change. In this chapter, I turn to literature that adopts a psychological, cultural or integral perspective. The research questions, objectives and methods for the literature review are as described in Chapter 3.

I have divided the chapter into three parts. In Part A, I consider psychological and personal perspectives on energy and climate change, including the motivations for behaviours that contribute to climate change and the individual experience of climate change. In Part B, I review cultural perspectives on energy and climate change, particularly notions of discourse, worldview, identity, ethics and participation. Finally, in Part C, I examine work that attempts integration across or within quadrants and draw conclusions about progress towards an integral understanding of climate change response.

Part A. Psychological perspectives

A psychological perspective draws attention to individual understanding of energy and climate change and personal motivations for energy consumption and climate change response. Literature associated with this quadrant explores the influence of personal experience, identity, values, attitudes and beliefs on individual behaviour. A psychological perspective encourages questions like:

- What motivates individuals to consume or conserve energy?
- What needs and desires are satisfied when energy is consumed?
- How well do individuals understand climate change and how does this influence their behaviour?
- How do people personally experience energy use and climate change?

In Section 4.2, I start my review by considering the sections of the IPCC's TAR that adopt a psychological perspective on climate change. In Section 4.3, I consider literature that examines motivations for energy consumption from the perspective of the individual. In Section 4.4 I review psychological models of climate change response, drawing partly on a broader literature concerned with the motivations for, and influences on, pro-environmental behaviour. In Section 4.5, I adopt a phenomenological perspective to explore individual experiences of energy use and climate change, and consider ways that this experience can be made more tangible. Finally, in Section 4.6, I consider uncertainty and its impact on individual expert assessments of climate change.

4.2 Psychological perspectives in the IPCC's Third Assessment Report

The main section of the IPCC's Third Assessment Report (TAR) that reviews psychological (and cultural) perspectives on climate change is Section 5.3.8 of the Working Group III contribution on climate change mitigation (IPCC 2001b, pp.367-373). Chapter 5 of the Working Group III contribution considers barriers, opportunities and market potential of technologies and practices for climate change mitigation. Section 5.3.8 specifically addresses social, cultural and behavioural norms and aspirations as a source of barriers to, and opportunities for, climate change mitigation. From a psychological perspective, the IPCC (2001b, p.367) notes that consumer behaviour is rarely rational in the strict economic sense, that there is a gap between professed values and action, that much of energy consumption is habitual or routine and that energy consumption and climate change mitigation is a low priority for most people. Further, it notes that motivation, habit, need, compulsion and identity all play a role in shaping consumption patterns (2001b, p.368). I will consider each of these issues in later sections.

Section 5.3.8 of IPCC (2001b) draws heavily on two sources. The first is a set of four volumes exploring social science research on climate change (Rayner & Malone 1998). These volumes were not developed under the auspices of the IPCC, but were intended to complement the IPCC's work. The second reports on an IPCC Expert Meeting on social, behavioural and cultural aspects of mitigation policies, held in March 2000 at Karlsruhe, Germany (Jochem, Sathaye & Bouille 2000). The Expert Meeting was held in response to a perception that these aspects of mitigation policies had been neglected by the IPCC. I will draw on both of these sources in later sections.

Some other sections of the IPCC's TAR also adopt a psychological perspective. Section 2.6 of the Working Group II contribution considers uncertainty and climate assessment. It reviews psychological literature on the quality of human judgement and identifies 'evidence for shortcomings and systematic biases in human decision-making' (IPCC 2001a, p.131). It argues that scientists need to build experience with subjective assessment methods and ensure transparency of assumptions when assessing science for policy makers (IPCC 2001a, p.132). I will draw on this literature in Section 4.6.

In addition, Section 9.10 in the Working Group II contribution touches on the psychological stress caused by forced migration of a type consistent with climate change (IPCC 2001a, p.473). Psychological impacts of floods, droughts and other natural disasters, such as post-traumatic stress disorder, are mentioned briefly in other sections of the report (e.g. IPCC 2001a, p.459). I will briefly consider the psychological impacts of climate change in Section 4.5.2.

4.3 Motivations for energy consumption

In this section, I consider literature on individual motivations for energy consumption. It is individual energy consumption that is ultimately responsible for the climate change problem, so understanding the personal benefits of energy use is crucial for an effective response to climate change (Douglas et al 1998).

In Section 3.3.4, I considered explanations of human behaviour as the rational act of maximising utility. According to neoclassical economic theory, people will act rationally to maximise their utility through consumption of material goods and services. However, as noted in Section 3.3.4, the assumption that humans act rationally to maximise personal utility is not supported by empirical evidence from energy demand management programs. In the sections below, I consider competing explanations for energy consumption based on satisfaction of needs (Section 4.3.1), establishment of personal identity (Section 4.3.2) and personality or lifestyle type (Section 4.3.3).

4.3.1 Energy consumption as a satisfier of needs

People consume energy not because it has any intrinsic value, but because it can be used to facilitate the satisfaction of personal needs and desires. That is, energy can provide services, such as warmth, comfort, light and mobility, that contribute to human well-being, health and happiness. There is an extensive literature on human needs, motivations and well-being (e.g. Dodds 1997a; Dodds 1997b;

Douglas et al 1998; Maslow [1954] 1987; Max-Neef 1991; Michaelis 2003; Wilhite & Lutzenhiser 1999). I will draw out important points from this literature below.

Types of need

One point of agreement in the literature on human needs is that there are different types of need. However, theories of human need rapidly diverge on how needs should be conceptualised and categorised. Perhaps the best known and most influential characterisation of human needs is the hierarchy of needs proposed by Maslow ([1954] 1987). Maslow's hierarchy starts with physiological needs for food, water, sleep and warmth. Once these needs are satisfied, the individual's motivation changes to the satisfaction of safety needs, then needs for belonging and love, esteem needs, aesthetic and cognitive needs and the need for self-actualisation. Thus, motivations are linked to the individual's position in the hierarchy of needs. Energy consumption can facilitate satisfaction of needs by, for example, providing warmth (a physiological need) or fuelling transport to visit friends (meeting the need for belonging and love).

Maslow's hierarchy has been criticised for presenting needs as rigid, exclusive categories when there is evidence that different needs may co-occur and the transitions between needs may be gradual (Douglas et al 1998, p.210). Other critics argue that the hierarchical ordering of needs 'legitimizes a distribution of power in favor of intellectuals and those who specialize in nonmaterial needs, such as ascetics' (Douglas et al 1998, p.210). Further, some theorists criticise Maslow's hierarchy for an individualist bias that excludes social and cultural influences on needs (Douglas et al 1998, p.211). I believe that these criticisms can be addressed by conceptualising Maslow's hierarchy of needs as a developmental line in the psychological quadrant. The integral conception of development allows different levels to coexist and be activated at different times, understands the transitions between levels as fluid and recognises that individual needs are culturally and socially situated. Further, integral theory contends that all levels in a hierarchy are important, arguing for inclusive power structures. Wilber (2000b, p.212) shows how Maslow's hierarchy of needs fits into an integral theory of psychology.

In an alternative theory, Max-Neef (1991) identifies nine types of fundamental human needs: subsistence, protection, affection, understanding, participation, idleness, creation, identity and freedom. However, Max-Neef makes the important distinction between fundamental human needs and the satisfiers used to meet those needs, arguing that the satisfiers could change across cultures and historical periods. This distinction is important for energy and greenhouse policy, as it implies that needs currently met through activities that consume significant quantities of energy could potentially be met either with lower energy consumption, or in completely different ways. Indeed, Max-Neef (1991) points out that people often use inappropriate satisfiers to meet their needs, so alternative ways of satisfying needs may in fact provide a greater degree of satisfaction.

Michaelis (2003, p.S139) distinguishes three categories of need that are met through consumption: 'individual needs for survival', 'individual social needs to attract a partner and demonstrate membership and status in a community' and 'collective social needs'. I will consider the role of consumption in establishing personal identity in Section 4.3.2. I will consider collective needs in Part B (Section 4.8).

Consumption and well-being

In addition to assuming that consumers will act rationally to maximise their utility, neoclassical economic models of human behaviour assume that greater material consumption equates to greater happiness and well-being (Hamilton 2003). This assumption appears to hold true until basic needs for nutrition, shelter and health have been met, but breaks down as consumption continues to grow beyond subsistence levels (e.g. Hamilton 2003; Inglehart 2000; Kahneman 2003; Layard 2003). I will consider three arguments against adopting this assumption in developed countries below.

First, Wilhite et al (2000) point out that individual behaviour is not motivated by a desire to consume energy, but by demand for the services that energy can provide, such as comfort, cleanliness and convenience (see also Shove 2003). These energy services help people to satisfy their needs. Importantly, the amount of energy required to supply an energy service is variable. This means that the well-being provided by energy services is not directly linked to the material level of energy consumption. Through energy efficiency improvements, the same level of service can be supplied with a lower level of energy consumption.

Second, some types of energy consumption are associated with activities that do not improve well-being. For example, excessive television viewing consumes energy but does not necessarily improve well-being. Similarly, sitting in traffic while driving to work consumes energy but can reduce well-being through stress and idleness. Hamilton (2003, p.69) discusses the role of consumption as 'a coping strategy, in which material goods compensate for the relative absence of emotional warmth'. This is an unhealthy type of consumption that does not truly improve well-being. Each new purchase may provide temporary satisfaction but does not satisfy deeper personal needs.

Finally, any real happiness generated through material consumption is gradually reduced through a process of habituation (Layard 2003). As the IPCC (2001b, p.368) points out: 'What was once luxury rapidly becomes habit and then need'. Individuals adapt to a particular standard of living and can only generate further increases in happiness by consuming even more:

> They are on what psychologists call the 'hedonic treadmill'. They try to rise up a rung but in the next period that rung is once again at the bottom, from which they again try to rise. We have essentially a problem of addiction, where people's past standard of living affects in a negative way the happiness they get from their present living standard (Layard 2003, Lecture 2, p.6).

Habituation makes any distinction between necessities and luxuries problematic, as these categories are not fixed. In addition, habituation helps to explain the empirical evidence that ongoing growth in material consumption in Australia and other Western countries has demonstrably failed to bring any significant increase in happiness (Hamilton 2003; Inglehart 2000; Layard 2003). It does appear that people in wealthier countries are happier, on average, than those in poorer countries (Inglehart 2000). However, once people have met their basic needs, further increases in wealth do not bring greater happiness (Inglehart 2000; Michaelis 2003). Instead, people define their happiness in terms of their relative wealth compared to others in their society. This creates a 'continual striving for more consumption in a cycle of "work and spend" [that] detracts from people's subjective well-being' (Michaelis 2003, p.S139). I will return to this point in Section4.8.1, from a cultural perspective.

4.3.2 Consumption and identity

The different types of human need identified by Maslow, Max-Neef and others help to broaden understanding of the motivations for consumption beyond simplistic models of utility maximisation and material satisfaction. Max-Neef (1991) lists identity as one of the fundamental human needs and the IPCC (2001b, p.369) recognised the establishment of personal identity as a powerful motivation for consumption in its TAR:

> In modern consumer societies, consumption patterns in particular are also used to establish and communicate identity. The combinations of goods people purchase help to confirm to themselves and express to others their personalities and values, their membership of particular social groups or communities, and their relationship to their social and physical environment.

Consciously or unconsciously, individuals display their personal values through their choice (or avoidance) of particular products and services, and these choices help to define the way they are seen by others. Hamilton (2003, p.67) gives the classic example of male car ownership, observing that 'for men cars are often "power objects", symbols of virility, strength, achievement and coolness, and that they may use cars to project this image'.

In Section 4.3.1, I mentioned comfort, cleanliness and convenience as some of the energy services that people actually desire. Given the above discussion, I would add establishment of identity and status to this list. The role of energy consumption in establishing identity and status poses significant challenges for policies that seek to reduce energy consumption. As noted by the IPCC (2001b, p.369): 'Some of the consumption choices that have the greatest effect on GHG emissions, such as car and house ownership and international travel, are also among the most significant means of establishing personal identity and group membership'. Climate change response policies must contend with the cultural desirability of some energy-intensive actions and offer alternative ways for individuals to establish their identity.

It is important to note that identity is not just a personal construction; it is also culturally mediated. I will consider the cultural influences on identity in more detail in Section 4.8. According to integral theory, both personal values and cultural norms change over time. This raises the possibility that the use of consumption to establish identity and status is a characteristic of a particular stage of personal and cultural development, rather than a fixed human trait. Inglehart (2000) identifies a trend away from materialist values and towards post-materialist values that supports this possibility. Using the value stages discussed in Section 2.3.5, concern with material achievement, individualism and status appears to be particularly associated with **modern** values. According to Beck and Cowan (1996, pp.244-252) it is at this value stage that individuals seek material abundance, recognition and affluence and are most concerned with conformity to norms of success and fashion. The attractions of material consumption begin to breakdown as **postmodern** values emerge (p.261).

4.3.3 Typological approaches

Typological approaches attempt to explain consumption patterns by identifying different personality or lifestyle types and linking these types to different consumption styles. There are numerous examples in the literature, based on different theories (e.g. Dake & Thompson 1999; Keys Young 2002; Pendergraft 1998; Shipworth 2000). I will consider two prominent approaches below, employing social marketing and cultural theory.

Social marketing

Social marketing is the application of commercial marketing techniques to the task of social change (Andreasen 1995, p.37). One of these techniques is to divide the market into segments so that information and education programs can be targeted to different customer groups (Andreasen 1995, p.52). Shipworth (2000) and Keys Young (2002) employ social marketing approaches in work conducted for the Australian Greenhouse Office. Shipworth (2000) draws on Gellings (1994), who identifies six market segments for residential electricity consumers: Pleasure Seekers, Appearance Conscious, Lifestyle Simplifiers, Resource Conservers, Hassle Avoiders and Value Seekers. Keys Young (2002) identify four market segments for a community-based GHG reduction program: Unconvinced Conservers, Committed Conservers, Non Believers and Convenience Choosers.

There is no clear theoretical basis for the choice of market segments; they are based on the experience and intuition of the marketer. Compared to the multiple developmental waves and streams of integral theory, these market segments are clearly a simplification that fails to do justice to the complexity of psychological holons. Further, social marketing has been criticised for focusing on the individual and giving too little attention to the social and cultural influences on consumption (Moisander 2000).

Cultural theory

Grid-group cultural theory has been used to provide a theoretical foundation for identifying different household consumption styles (Dake & Thompson 1999) and cultural types (Pendergraft 1998) in the context of energy consumption and climate change response. As grid-group cultural theory is primarily concerned with collective holons (groups), I will discuss it in more detail in Part B (Section 4.9). Here, it is sufficient to note that grid-group cultural theory is a structural method that identifies fatalist, hierarchical, individualist, egalitarian and autonomous behavioural styles.

4.4 Psychological models of climate change response

The discussion in Section 4.3 indicates that energy is not consumed for its intrinsic value, but to provide various energy services, such as comfort, cleanliness, convenience and establishment of identity. Attitudes towards energy consumption are linked to subjective values, lifestyle choices and context. To be effective, demand management programs need to consider the psychological influences on energy consumption and how these are related to motivations to conserve energy or respond to climate change.

There is an extensive literature exploring the motivations for energy demand management (e.g. Brandon & Lewis 1999; Wilhite et al 2000), climate change response (e.g. Bulkeley 2000a; Jaeger et al 1993; Thompson & Rayner 1998a) and pro-environmental behaviour more generally (e.g. Clark, Kotchen & Moore 2003). This literature proposes several different models to explain the psychology of climate change response; I will use these models to structure my discussion. In Section 4.4.1, I discuss an information deficit model that links climate change response to knowledge and understanding of climate change. In Section 4.4.2, I consider a socio-demographic model that explains climate change response in terms of variables such as gender, age and income. In Section 4.4.3, I examine explanations of climate change response based on individual values and attitudes. Finally, in Section 4.4.4, I identify an emerging consensus that socio-cultural models provide a superior explanation of climate change response than the other three models.

4.4.1 Information deficit models

As the literature review in Chapter 3 indicates, climate change is a complex scientific issue plagued by uncertainty. It is also a contested issue, with many different views presented in the public domain. It is not surprising, then, that international and Australian studies typically find poor public understanding of the causes, mechanisms and impacts of climate change (Bostrom et al 1994; Bulkeley 2000a; Dunlap 1998; Kempton 1997). In a NSW survey by the Department of Environment and Conservation (DEC 2004, p.29), 55 per cent of respondents incorrectly believed that: 'The greenhouse effect is caused by a hole in the Earth's atmosphere'. In national survey research for the AGO by Colmar Brunton Social Research and Redsuit Advertising (CBSR & RA

2003), 20 per cent of respondents believed that ozone was the cause of global climate change; only 15 per cent specifically identified fossil fuel combustion, the largest contributor to climate change. Survey and focus group research by the AGO (2002a) found that only 55 per cent of participants knew that electricity use contributes to GHG emissions and very few participants recognised the contribution of households to climate change.

Low public understanding and confusion about climate change is problematic for two reasons. First, if people do not know about climate change, its impacts and the ways they can respond, they are unlikely to prioritise climate change response in their own actions. Second, if people misunderstand the causes of climate change, they may misguidedly prioritise actions that do not necessarily help to address the problem. Theoretically, improving public understanding of climate change should facilitate climate change response. This conclusion is the basis of the **information deficit model** of climate change response.

The information deficit model, also known as a knowledge-focused model, contends that public ignorance of climate change is 'a barrier to effective public involvement in the policy process' and that public education to provide better information on climate change will improve involvement and prompt behavioural change (Bulkeley 2000a, p.313; Thompson & Rayner 1998a, p.267). This type of model is consistent with the rational models of human behaviour discussed in Section 3.3.4 in its assumption that individuals will respond rationally to information. An information deficit model underlies, often implicitly, many of the information and education programs used by government authorities in Australia to promote demand management and climate change response.

Information deficit models have been criticised on several grounds. First, as Thompson and Rayner (1998a, pp.266-279) point out, information deficit models are based on a simple distinction between expert and lay understanding of climate change that treats both experts and the public as homogenous groups. They argue that there are systematic variations in values and cultural orientations within these groups and that these variations have greater influence on the individual's response to climate change. Crucially, as Kempton (1997) points out, people interpret issues like climate change by applying existing cultural models about the way the world works. They do not passively receive information, nor do they respond to it consistently. These insights have led to the development of socio-cultural models of climate change response, discussed in Section 4.4.4.

Second, several authors argue that public ignorance of the exact scientific mechanisms of climate change should not be construed as ignorance of the problem (Bulkeley 2000a; Thompson & Rayner 1998a). Rather, the public interprets climate change more broadly as a member of the 'category of environmental insults deriving from industrial society' (Thompson & Rayner 1998a, p.273). As Bulkeley (2000a, p.329) puts it: 'Rather than being an isolated concern, climate change is seen as emblematic of the nature of environmental problems: the relations between society and nature, experts and the public, and local and global communities'. The public does not need to understand the scientific detail of climate change to draw out the social and environmental relationships that are at the heart of the climate change problem and to identify a moral imperative to respond.

Jaeger et al (1993) tested the performance of a knowledge-focused model against socio-demographic (Section 4.4.2) and socio-cultural models (Section 4.4.4) as a determinant of environmental action with regard to climate change in the Surselva region in Switzerland. The authors found that knowledge of climate change has much less influence on behaviour than the social and cultural networks in which people are embedded.

The criticisms of information deficit models discussed above do not mean that knowledge has no influence on motivations for demand management and climate change response. Numerous studies have shown that tailored information, advice and feedback can help people to reduce their energy consumption (e.g. Brandon & Lewis 1999; Darby 2001; Wilhite & Ling 1995; Wood & Newborough 2003). The point is simply that knowledge alone is a poor predictor of the likelihood that an individual will act to reduce energy consumption or otherwise respond to climate change.

4.4.2 Socio-demographic models

Socio-demographic models attempt to explain the probability that a person will act to reduce energy consumption or GHG emissions through reference to their socio-demographic characteristics. Age, level of education and gender have been found to influence environmental concern in general (Jaeger et al 1993). Brandon and Lewis (1999), in a quantitative and qualitative study of households in the UK, found that income, age, household size and type of tenure (e.g. owner-occupier or tenant) influenced the pre-existing level of energy consumption but did not influence changes in energy consumption in response to a feedback trial. They found that environmental attitudes and the type of feedback had a greater influence on changes in energy consumption. I will consider attitudinal models in Section 4.4.3.

Jaeger et al (1993), in their comparison of knowledge-focused, socio-demographic and socio-cultural models, found that the socio-demographic model was inferior to the socio-cultural model in explaining the probability that people would take environmental action with regard to climate change. However, the socio-demographic model did perform better than the knowledge-focused model. Women were slightly more likely than men to take climate-relevant action, older people were more likely to take action than younger people and self-employed (including farmers) and employees were more likely to take action than workers. With the exception of the result for gender, the authors suspected that these results might be peculiar to the mountainous rural region in which the research was conducted (Jaeger et al 1993, pp.205-206).

4.4.3 Attitudinal models

A third type of psychological model links the likelihood of pro-environmental behaviour to individual values or attitudes, without necessarily invoking any social or cultural influence on those values or attitudes. An attitudinal model addresses some of the constraints of an information deficit model, as it is concern about climate change rather than knowledge of climate change that prompts action. In the Australian survey mentioned in Section 4.4.1, 67 per cent of respondents were extremely concerned (29 per cent) or concerned (38 per cent) about climate change (CBSR & RA 2003). This high level of concern is despite the low level of knowledge revealed in the same survey. Almost all survey respondents indicated that they had taken some form of action in the previous six months to reduce energy use, so an attitude of concern would appear to be a better predictor of action than knowledge in this case.

The role of attitudes in predicting action is supported by other literature. Brandon and Lewis (1999) found that the existence of positive environmental attitudes, measured through agreement with statements about environmental beliefs and personal behaviour, had a statistically significant influence on reductions in energy consumption in the households they studied. Similarly, Clark, Kotchen and Moore (2003) found that altruistic attitudes and positive environmental attitudes were significant in a mathematical model of the decision to participate in a green electricity program. Maiteny (2002) hypothesises that behavioural change driven by inner attitudes and meaningful experiences is more likely to endure than behavioural change prompted by external influences, such as regulations, incentives or anxiety. In integral terms, it is only when people develop values consistent with ecological awareness (i.e. postmodern values) that they will freely adopt pro-environmental behaviours.

Kahn (1999) is one of the few authors to explicitly use structuralism to explore the development of individual environmental attitudes and values. Kahn's interview research provides evidence that a biocentric moral attitude emerges through a developmental process that integrates 'human-oriented and nature-oriented considerations within a larger mental organizational structure' (p.105). In other words, 'children's moral relationships with other humans help establish their moral relationships with nature, and vice-versa' (p.212). Thus, attitudes to environmental issues, like climate change are not fixed; they are constructed through interactions with nature and with other people. Kahn's research confirms that varying moral value structures are an important predictor of pro-environmental action.

However, the relationship between expressed values (or attitudes) and pro-environmental action is not a straightforward one. Blake's (1999, p.275) interview research in the UK identifies a 'value-action gap' – a discrepancy between 'what people say and what people do'. While people may express environmental values and concerns when asked, there is no guarantee that this expressed concern will translate to pro-environmental behaviour. The Australian survey by Colmar Brunton

Social Research and Redsuit Advertising (CBSR & RA 2003) supports Blake's findings. Most respondents (81 per cent) claimed that reducing household energy consumption was important (40 per cent) or extremely important (41 per cent) (CBSR & RA 2003). However, the same survey found that 66 per cent of respondents felt they could do more to reduce their energy consumption and a further 6 per cent would like to do things to reduce energy use but were not actually doing anything (CBSR & RA 2003). This is the same gap between values and action identified by Blake.

According to Blake, there are numerous barriers that prevent translation of environmental concern into action. He identifies three types of barrier: personal attitudes or cognitive structure, the social context and practical social and institutional constraints. These barriers span the quadrants and all are potentially applicable to climate change response. Individual psychological barriers identified by Blake (1999, p.266) include laziness, lack of interest, lack of trust or a belief that one is 'the wrong type of person to do certain types of environmental actions'. Bulkeley (2000a) concurs and argues that the challenge for policy makers is to move from a policy model focused on educating the public towards a policy model focused on the removal of social and institutional barriers that prevent individuals from taking desired action.

4.4.4 Socio-cultural models

There is an emerging consensus that socio-cultural models, or cultural network models, are better able to explain motivations for demand management and climate change response than alternative models (Jaeger et al 1993; Moisander 2000; Thompson & Rayner 1998a; Wilhite et al 2000). Socio-cultural models link the likelihood of pro-environmental behaviour to the socio-cultural processes, networks and paradigms to which people are exposed (Jaeger et al 1993). The social and institutional barriers identified by Blake (1999) and Bulkeley (2000a) are part of the socio-cultural context, so socio-cultural models potentially provide a way of understanding the value-action gap.

Jaeger et al (1993) developed a socio-cultural model that took into account exposure to cultural rules favouring climate-relevant environmental action, involvement in social networks emphasising problems like climate change and interest in political affairs. They found that this model was a 'dramatically better' predictor of climate-relevant action than the knowledge-focused and socio-demographic models (Jaeger et al 1993, p.206). These findings, and work by other authors (e.g. Thompson & Rayner 1998a; Wilhite et al 2000), indicate that the individual decision to respond to climate change is socially and culturally mediated. Any explanation focusing on individual psychology alone is partial. This, of course, is exactly what integral theory argues. I will consider cultural models of climate change response in detail in Part B.

4.5 Experiencing energy consumption and climate change

In this section, I will consider the individual experience of energy consumption and climate change. I draw on my own phenomenological experience here in addition to relevant literature, including some of my own research (Riedy et al 2004). I discuss the experience of energy use in Section 4.5.1 and the experience of climate change in Section 4.5.2. One of my contentions is that both these experiences are intangible and that this intangibility contributes to a low prioritisation of demand management and climate change response. In Section 4.5.3, I will consider some of the ways in which energy use and climate change can be made more tangible.

4.5.1 The experience of energy use

Human senses perceive energy in various ways. Eyes register light energy and changes in the quality of light. Ears register sound energy, such as the hum of a motor or the crashing of waves. Skin registers the thermal energy in sunlight or in air warmed by an electric heater. However, while humans are capable of sensing environmental fluxes of energy, the nature of these perceptions is qualitative rather than quantitative. Further, the safety hazards associated with most common energy sources, such as electricity, petroleum products and natural gas, mean that the energy system is necessarily designed to prevent people interacting with energy. For both these reasons, it is difficult to perceive how much energy one is using during the act of consumption. Instead, energy consumption is usually quantified at some later time, in an energy bill or meter reading. By the time the bill arrives, often months later, it is too late to modify consumption practices. Quantitative feedback is severely delayed.

When the energy bill does arrive, it reports energy consumption in aggregate terms without identifying the activities that were responsible for the measured energy consumption.[35] This makes it very difficult for people to interpret whether an increase (or decrease) in their measured energy consumption is due to a change in their behaviour, the purchase of a new appliance, a leaking hot water tap, or some other factor. Available feedback lacks the specificity required to guide behavioural change. It does not make energy use tangible at the point of use.

Even if energy consumption could be made more tangible at the point of use, it remains a difficult task to associate some types of energy use with negative environmental impacts. Electricity, for example, has no negative impacts at the point of use and is conveniently available at the flick of switch. It is easy to remain unaware, in our everyday lives, of the long chain of fossil fuel-fired infrastructure that sits behind every electric switch. Market research confirms that a very low proportion of people link their household electricity use to the combustion of fossil fuels (Bulkeley 2000a; Keys Young 2002). The environmental impact of flicking the switch is not tangible and

[35] At least, this is the case in Australia. Smart meters that record energy consumed by different appliances are available but are not routinely employed anywhere in Australia.

immediate. In contrast, combustion of petroleum in vehicles produces tangible exhaust fumes that can be smelt and often seen. Perhaps this helps to explain why 38 per cent of respondents to the CBSR and RA (2003, p.23) survey, discussed earlier in this chapter, listed vehicle emissions as 'a top-of-mind human activity that contributes to climate change' and only two per cent mentioned 'overuse of electricity'. In fact, electricity generation contributes 33 per cent of Australia's net GHG emissions and transport contributes only 14 per cent (AGO 2004c).

Finally, the cost of energy usually comprises a very small proportion of total household or organisational expenditure. The average Australian household spends about 2.5 per cent of weekly expenditure on domestic fuel and power and about 3.5 per cent on petrol (ABS 2000b). Although there are often cost-effective opportunities available to reduce energy bills, the absolute savings in monetary terms are relatively minor. The low cost of energy services, combined with the intangible nature of energy use, make demand management a low priority for most people.

4.5.2 The experience of climate change

Humans are quite capable of sensing changes in the weather although, in modern Western civilisation, people spend large stretches of time cocooned in air-conditioned houses, vehicles and offices where opportunities to experience such changes can be scarce. Nevertheless, changes in the weather occur on a timescale that is consistent with human sensory experience. We can watch the clouds roll across the sky, feel the first drops of rain and smell the ozone before an electrical storm.

The same cannot be said for changes in the climate. Climate change is not revealed through personal sensory experience but through the extension of human senses with scientific instruments. Humans cannot directly experience changes in the climate because the temporal scale is so different to that of normal experience. Certainly, people may have a vague sense that the climate used to be different when they were younger, but this is not a felt experience; it is a mental reconstruction that may be distorted by many factors.

Further, even a human life is short compared to the timescale of climate change. Kahn (1999, p.7) identifies a phenomenon called 'environmental generational amnesia'. He argues that:

> People may take the natural environment they encounter during childhood as the norm against which to measure environmental degradation later in their life. The crux here is that with each ensuing generation, the amount of environmental degradation increases, but each generation takes that amount as the norm, as the nondegraded condition…[If] environmental generational amnesia exists, it helps provide a psychological account of how our world has moved towards its environmentally precarious state (Kahn 1999, p.7).

Pawlik (1991) identifies five psychological characteristics that help to explain why humans find it difficult to respond to climate change. First, the increases in temperature predicted by the IPCC as a consequence of climate change (up to 5.8ºC by 2100) are within the range of existing diurnal and seasonal temperature variation. Humans cannot discern a sensory climate change signal from the background noise of this existing variation (Pawlik 1991, p.560). Second, experimental research indicates that the consequences of a behaviour must be felt within hours if they are to provide potent positive or negative reinforcement for that behaviour (p.560). The impacts of climate change come years after the behaviour that caused them and do not comply with this requirement. Third, people 'tend to systematically underestimate the relative frequency of rare events', such as natural disasters associated with climate change (p.561). Fourth, 'human social learning tends to be a function of interpersonal proximity of the social partners taking part' (p.561). In the case of climate change, there are vast spatial and temporal distances between the actors contributing to climate change and the victims of climate change.[36] Finally, from the perspective of an individual actor motivated by short-term self-interest, actions that contribute to climate change are generally more cost-effective than actions to respond to climate change.[37]

An additional psychological characteristic, not mentioned by Pawlik, is the sense that climate change is such a big problem that the actions of an individual citizen – positive or negative – are of little consequence. Climate change is a global problem, requiring global cooperative solutions, and achieving such widespread cooperation can seem hopeless. This raises the issue of responsibility. In the CBSR and RA (2003) survey, 59 per cent of respondents stated that the responsibility for addressing climate change fell on everyone equally. That is, the majority of survey respondents accept that they have personal responsibility for addressing climate change, but also feel that the burden of action must be shared across society. Unless an individual perceives their actions as part of a wider effort to address climate change they are unlikely to feel that those actions will make a difference.

The current public perception in Australia seems to be that government and industry are not doing enough to address climate change. In the above-mentioned survey, 53 per cent of respondents did not believe that the Commonwealth Government was doing anything about climate change and a further 14 per cent did not know if anything was being done (CBSR & RA 2003). Further, Bulkeley's (2000a, p.315) interview research in Newcastle, Australia, found that:

> Although morally sanctioned, and seen as a valid means of achieving other goals, actions taken by individuals to reduce energy use for environmental reasons were thought to be largely ineffective in a context of inertia from influential institutions (business and government) in which people held little trust.

It seems that many Australians do not trust government and industry to meet their responsibilities to address climate change, which contributes to the perception that individual actions are meaningless. An important objective of any integral response to climate change must be to build trust between the public, government and industry.

[36] People in developed countries have contributed most to climate change, whereas people in developing countries, and future generations, will bear a disproportionate amount of the impacts. In addition to the spatial and temporal distance between actors identified by Pawlik, there is also a cultural distance.

[37] Of course, one of my main points in this thesis is that all people are not motivated purely by short-term self-interest, so Pawlik's last psychological characteristic is not universal.

As a consequence of all the factors discussed above, the experience of climate change remains tenuous, uncertain and distant from the tangible realities of daily life for most people. In surveys, climate change is invariably ranked as less important than other environmental issues, like air and water pollution, that have a direct and tangible impact on health and quality of life (DEC 2004; Keys Young 2002). Preparing for uncertain future impacts is not a high priority when there are more pressing and immediate concerns with more immediate impacts (Abramovitz 2001, p.29).

It should not be forgotten that the experience of climate change is very different for those people that are already suffering its impacts. While it is not possible to link specific natural disasters to climate change, the upward trend in natural disasters in recent decades (see Munich Re 2004) is consistent with predicted climate change impacts. The psychological (and physical) impacts of natural disasters are devastating for the victims and need to be held in mind in any comprehensive consideration of the experience of climate change.

4.5.3 Making energy use and climate change tangible

Given that the experiences of energy use and climate change are currently so tenuous, one of the challenges for policy makers concerned with climate change response is to make these experiences more tangible. For energy use, this typically involves the provision of better feedback through information and education programs (e.g. energy efficiency labelling), more comprehensive bills (e.g. showing GHG emissions and benchmarks) and various metering and display solutions (e.g. interval meters that record and display energy use every half hour). In addition, energy tariff structures can be modified to provide a stronger price signal for demand management. Riedy and Wilson (2004) review policy options for household feedback on energy use in more detail. Numerous authors have found that improved feedback leads to reductions in energy consumption (e.g. Brandon & Lewis 1999; Darby 2001; Wood & Newborough 2003). However, other authors have found that some people increase their consumption in response to such feedback, as they realise that particular appliances cost very little to run (Oliphant 1999).

To provide a stronger public experience of climate change, non-government organisations (NGOs) in Australia have attempted to link particular events, such as Australia's recent drought, to climate change (e.g. Karoly, Risbey & Reynolds 2003). The rationale is that this will invest climate change with the visceral, felt experience of natural disaster and strengthen resolve to take action. However, scientific uncertainty makes it impossible to link particular events to climate change with absolute certainty, which somewhat weakens the impact of such an approach.

Another approach recently attempted by Australian NGOs is to invite speakers from impacted developing countries to tour Australia and share their experiences. The Climate Justice Tour took place from 24 April to 9 May 2004 and involved speakers from Tuvalu and Samoa, countries experiencing the impact of sea level rise, and Nigeria, which has experienced environmental and social impacts as a consequence of fossil fuel exploitation (see FOE Australia 2004). The intent of the tour was to raise equity issues by exposing people in a developed country to the real human impacts that climate change is having in developing countries. I will consider equity issues in more detail in Section 4.10.

One interesting approach that allows citizens to 'express their spontaneous associations with climate change and energy use' is described by Kasemir et al (2003a). In focus groups held within the context of a participatory integrated assessment project on climate change, participants were asked to produce and discuss collages associated with different energy use scenarios. This revealed the way people experience climate change and the way they expect to experience it in the future. In general, negative collages were associated with continuation of present trends and positive collages were associated with strong reductions in energy use. Collages also expressed uncertainty about the future. By encouraging participants to use artistic expression to describe their associations with energy and climate change, the collage process brought about a new type of engagement with the problem.

In Chapter 8, I will consider the role of feedback, artistic expression and participation in making energy use and climate change more tangible and thereby contributing to an integral response to climate change.

4.6 Uncertainty

Uncertainty, the IPCC (2001a, p.126) points out, is 'a perennial issue for science' and this is especially so for an issue like climate change. There are many different types of risk, uncertainty and surprise. Schneider, Turner and Garriga (1998, pp.171-172) provide useful definitions in the context of global change:

- Risk: 'the condition in which the event, process or outcome, and the probability that each will occur, is known'
- Uncertainty: 'The condition in which the event, process, or outcome is known (factually or hypothetically), but the probabilities that it will occur are not known, or are highly subjective estimates'
- Surprise: 'The condition in which the event, process or outcome is not known or expected'
- Imaginable surprise: 'The event, process, or outcome departs from the expectations of the observing community or those affected by the event or process'.

Much has been written about risk, uncertainty and surprise, both generally and in the context of climate change (e.g. Adams 1995; Beck 2002; Bulkeley 1997; Funtowicz & Ravetz 1993). I do not intend to review this literature in detail here. For my purposes in this thesis, it is sufficient to draw out two points. First, while uncertainty can be reduced in some cases by collecting more data or undertaking more model runs, there is usually residual uncertainty and, in complex systems like the climate system, there is always the possibility of surprise. As Wilber (2000c, pp.55-56) puts it, 'we never know, and never can know, exactly what any holon will do tomorrow (we might know broad outlines and probabilities, based on *past* observations, but self-transcendent emergence always means, to some degree: surprise!)'. This means that, as discussed in Section 3.7.2, predictive modelling approaches do not provide the basis for robust policy development.

Second, the existence of uncertainty and surprise necessitates subjective judgements by individuals involved in scientific assessment of climate change and development of policy responses to climate change. Unfortunately, most of the evidence indicates that human judgement is quite poor under conditions of high uncertainty and 'vulnerable to systematic error and bias' (IPCC 2001a, p.131). The IPCC argues for greater attention to the subjective methods used in scientific assessments and for transparent presentation of these methods (IPCC 2001a, p.132). Other ways to address uncertainty include scenario planning, discussed in Chapter 5, and collective decision-making processes, discussed in Section 4.11. In Chapter 5, I will also consider the treatment of uncertainty in some of the specific tools used for energy policy development in Australia.

Part B. Cultural perspectives

A cultural perspective draws attention to shared understanding of energy and climate change and the collective meanings that underpin different responses to climate change. Literature associated with this quadrant considers the symbols, values, discourses, worldviews, myths, metaphors, beliefs and group identities associated with energy consumption and climate change response. That is, it considers the interior structures of collective holons. A cultural perspective prompts questions like:

- What are the cultural factors that influence energy consumption?
- How do different discourses interpret climate change?
- What is an ethical response to climate change given the existence of diverse cultural perspectives?
- How do we reach collective decisions on climate change response?

I will start my review, in Section 4.7, by identifying cultural perspectives in the IPCC's TAR and discussing literature that studies the culture of the IPCC itself. In Section 4.8, I examine cultural attitudes towards consumption, with a specific focus on energy consumption. In Section 4.9, I review literature that identifies different discursive interpretations of climate change. In Section 4.10, I discuss the ethics of climate change response. Finally, in Section 4.11, I describe the collective decision-making processes used to respond to climate change and proposals for alternative processes.

4.7 Cultural perspectives and the IPCC

In this section, I consider two ways in which a cultural perspective is relevant to the IPCC. In Section 4.7.1, I review the extent to which cultural perspectives are considered in the TAR. In Section 4.7.2, I discuss literature that analyses the worldview and culture of the IPCC, typically from a critical position.

4.7.1 Culture in the Third Assessment Report

As discussed in Section 4.2, Section 5.3.8 of the Working Group III contribution to the IPCC's TAR is the main section that reviews cultural perspectives on climate change response. Section 5.3.8 considers the role of culture in shaping energy consumption patterns. It identifies discourses, symbols and group identities as drivers of energy consumption and notes the varying cultural significance of different energy-consuming practices (IPCC 2001b, p.368). I will consider cultural influences on consumption in Section 4.8.

The TAR also identifies different discourses or narratives through which climate change is understood, drawing primarily on grid-group cultural theory (IPCC 2001b, p.372). The IPCC (2001b, p.370) argues that competing discourses are a barrier to climate change mitigation and that building a common discourse, or narrative, about climate change is a high priority. I will consider climate change discourses and the theories used to derive them in Section 4.9.

Finally, Section 5.3.8 of the TAR considers the ethics of GHG mitigation, particularly the 'commons dilemma' (IPCC 2001b, p.370). Ethics is also considered elsewhere in the report, particularly in the context of decision-making frameworks (e.g. IPCC 2001b, Chapter 10) and economic analysis (e.g. IPCC 2001a, p.98). I will discuss the ethics of climate change response in Section 4.10.

Cultural issues are considered in other sections of the TAR, besides Section 5.3.8. In particular, the Working Group II contribution to the TAR considers possible cultural impacts of climate change in different parts of the world throughout its assessment (IPCC 2001a).

4.7.2 The worldview of the IPCC

Since its inception, the IPCC has been subject to criticism for excluding particular worldviews or conceptual frameworks from its assessment process (Cohen et al 1998; Healy 2003; Michaelis 2003; Najam et al 2003; Ney & Thompson 2000; Robinson & Herbert 2001; Spash 2002; Swart, Robinson & Cohen 2003). Criticisms focus on incomplete integration of issues of development, equity and sustainability into assessment reports and inadequate consideration of the linkage between climate change and broader issues of lifestyle and culture (Swart, Robinson & Cohen 2003). To its credit, the IPCC has gradually responded to these criticisms through a process of organisational learning (Siebenhüner 2002). I will summarise the learning process and its influence on the IPCC's worldview below.

When the IPCC was formed, climate change was framed as a predominantly scientific problem 'related to the long-term disturbance of the global geo-biochemical cycles and the associated effects on global climatic patterns, modelled in complex Global Circulation Models' (Swart, Robinson & Cohen 2003, p.S20). That is, the problem was framed as an '*environmental* crisis, to the exclusion of its social, cultural, moral, and political dimensions and their connections to other pressing environmental and social problems such as hunger, poverty, and North-South inequities' (Cohen et al 1998, p.343). This framing of the problem was consistent with the natural science agenda of the organisations that founded the IPCC – the WMO and UNEP (Swart, Robinson & Cohen 2003). From this natural science perspective, climate change mitigation was a technical problem of GHG emission reduction to be solved through the reductionist application of GCMs and technical and instrumental rationality (Cohen et al 1998). Consequently, the FAR focused predominantly on climate science and climate change impacts, with an emerging focus on the cost-effectiveness of mitigation options (IPCC 2001b, pp.77-78).

By the SAR, equity had emerged as an important consideration for assessment of mitigation options (IPCC 2001b, pp.77-78). However, the SAR continued to define climate change in the terms of natural science; social science analysis was not integrated into the report, except in the limited case of economic analysis of the cost-effectiveness of mitigation options (Cohen et al 1998). Finally, in the TAR, the IPCC attempted to broaden its focus by reviewing mitigation options within a broader context of development, equity and sustainability (IPCC 2001b, pp.77-78). However, as Swart, Robinson and Cohen (2003) point out, this broader treatment is confined to a few chapters and has yet to be fully integrated into the IPCC's assessment.

The IPCC provides an interesting case study of the evolution of worldview within an organisation towards greater inclusion. The IPCC began with a narrow techno-economic, or scientific rationalist perspective on climate change that excluded the perspectives of social scientists and, to a large extent, people in developing countries (Najam et al 2003). Gradually and hesitantly, the worldview has expanded to include development, equity and sustainability concerns (Najam et al 2003) and the views of social scientists (e.g. Jochem, Sathaye & Bouille 2000; Rayner & Malone 1998). The increasingly inclusive peer review process adopted by the IPCC and a willingness to reflect on past experience and criticisms are seen as important factors in this gradual widening of worldview (Siebenhüner 2002).

However, the 'widening of worldviews and conceptual frameworks' necessary to address 'the roles of human behaviour, consumption and lifestyles in climate responses' remains incomplete (Michaelis 2003, p.S136). Most of the cultural issues considered in the remainder of this chapter, such as the culture of consumption, the role of discourse in mediating the response to climate change and the ethics of climate change mitigation received only limited treatment in the TAR. Further, in striving for scientific and political neutrality (see Section 3.2.1), the IPCC resists open recognition of subjectivity and the role of values in scientific assessment. It entrenches the sovereignty of objectivist epistemology and instrumental scientific rationality (Healy 2003). Several authors have proposed ways to increase integration of subjective knowledge and alternative perspectives in future assessments (Healy 2003; Najam et al 2003; Swart, Robinson & Cohen 2003). I will provide my own proposals in Chapter 8.

4.8 The culture of consumption

In Section 4.3, I discussed individual motivations for energy consumption, specifically satisfaction of wants and needs, establishment of identity and identification with particular lifestyles or consumption styles. There, I noted that individual motivations are culturally mediated. I will review the cultural influences on energy consumption in Section 4.8.1. Given that consumption is culturally mediated, there may be specific characteristics of Australian culture that encourage or discourage energy consumption. I will discuss this possibility in Section 4.8.2. Finally, if culture does influence energy consumption (and climate change response), then policy approaches need to find appropriate ways to make demand management and climate change response culturally attractive. I consider approaches that seek to build a culture of climate change response in Section 4.8.3.

4.8.1 Cultural influences on consumption

In Section 4.3.1, I discussed energy consumption as a way of providing energy services that satisfy individual wants and needs. However, individual wants and needs are not formed in isolation. As Douglas et al (1998, p.259) put it: 'Human needs and wants are generated, articulated, and satisfied in an institutionalized feedback system. They do not appear from thin air but are created by the social interactions that comprise the civic community'. The social and cultural context, the discourses in which an individual participates and the norms to which he or she conforms all influence the needs and wants that an individual perceives (Douglas et al 1998; Hamilton 2003; Michaelis 2000b, 2003; Thompson 2000).

In Section 4.3.1, I mentioned three categories of need identified by Michaelis (2003) that drive consumption. It is worth returning to these categories in a cultural context. The first category identified by Michaelis (2003, p.S139) comprises 'individual needs for survival', or subsistence needs. These needs include nutrition, health and safety. I would argue, following Maslow ([1954] 1987) and Max-Neef (1991), that these basic subsistence needs are universal. However, the way in which these needs are met is socially constructed. For example, cultural tradition, symbolic associations transmitted through news and advertising media, household or family structure, examples set by peers and infrastructure constraints all influence the choice of food to satisfy the need for subsistence. This choice can have significant implications for energy consumption and GHG emissions. If advertising creates a market for exotic or seasonal ingredients that must be transported long distances, instead of locally grown ingredients, the energy consumption used to satisfy the need for nutrition will rise. While the underlying need may be universal, the means used to satisfy that need will vary with social and cultural context (Max-Neef 1991).

The second category identified by Michaelis (2003, p.S139) comprises 'individual social needs to attract a partner and demonstrate membership and status in a community'. This is the idea of conspicuous consumption, first raised by Veblen ([1899] 2001). By conspicuously purchasing and using expensive products and services, individuals can demonstrate their wealth and status relative to other members of society. If wealth and status are valued in a particular culture, then this conspicuous consumption can help an individual to attract a partner. Consumption decisions driven by the need to attract a partner may not be economically rational. For example, 'public transport may provide fast, efficient mobility for certain trips, but young men may see car ownership as the only way to attract a girlfriend' (IPCC 2001b, p.368). The need to attract a partner, rather than any rational economic calculation, is the underlying driver for the consumption behaviour.

From the perspective of climate change response, conspicuous consumption is problematic because it contributes to ongoing escalation of energy consumption levels and GHG emissions. People buy some energy-consuming products, such as the latest four-wheel drive vehicle or a sprawling family home with an air-conditioning system and a full complement of appliances, not only for their utility but also as a way of symbolically transmitting information about their wealth and status to other members of the culture. However, wealth and status are defined relative to other members of society (Hamilton 2003; Kahneman 2003; Layard 2003). As Layard (2003, Lecture 2, p.8) puts it, 'people are concerned about their relative income and not simply its absolute level. They want to keep up with the Joneses or if possible to outdo them'. Consequently, individuals constantly compare their wealth and status with rivals and, where the comparison is unfavourable, develop new desires that drive further consumption. This is the cultural dimension of the hedonic treadmill discussed in Section 4.3.1.

The third category of needs identified by Michaelis (2003, p.S139) are 'collective social needs to establish bonds within a family or other group; to establish and communicate shared identity; and to establish and communicate values, ethics and culture'. There are two types of need within this category. The first is the need to establish group bonds. Shared consumption decisions, such as the choice to go on a holiday together or see a movie together, are a way of establishing these bonds. The second is the need for individuals to symbolically display their subjective values and group identification to other individuals. Consumption is a symbolic act that reveals something of what an individual thinks, feels and values. As Hamilton (2003) points out, when people consume a product, they also consume a whole raft of associated symbols, values and images that help them to express their identity to other members of the consumer culture.

Advertisers are adept at using cultural symbols and appeals to underlying psychological needs to make their products attractive to consumers (Hamilton 2003). The pervasiveness of advertising makes it difficult to avoid exposure to constant images of the desirability of consumption. These images create an impression that high-consumption lifestyles are normal. Consumption consequently becomes something seen as necessary to be accepted as normal (Ger et al 1998).

The different types of need discussed above combine to support a culture of consumption in modern Western society that constitutes a significant barrier to efforts to reduce energy demand and respond to climate change. Disturbingly, as noted in Section 4.3.1, this culture of consumption promises happiness but fails to deliver. According to Layard (2003, Lecture 1, p.14):

> People in the West have got no happier in the last 50 years. They have become much richer, they work much less, they have longer holidays, they travel more, they live longer, and they are healthier. But they are no happier.

The happiness provided by consumption is diluted not only by the individual processes of habituation discussed in Section 4.3.1, but also by cultural processes of comparison. Each individual compares their wealth, status and identity to their peers and can always identify someone who has more. Further, the mass media promotes a lifestyle of high material consumption and affluence through transmission of narratives and images that link consumption to satisfaction of needs and desires, status, celebrity and identity (Michaelis 2001). Continual exposure to images of conspicuous consumption in the mass media helps to reinforce a perceived gap between actual affluence and desired affluence. The media create an aspiration to an unrealistic lifestyle that few people in a culture actually live (Schor 1998), thereby 'reinforcing current trends towards more GHG-intensive lifestyles' (IPCC 2001b, p.369).

I should stress here that there is not one cultural attitude to consumption but many, and some of these may place little value on material consumption (Michaelis 2000b). Indeed, there is evidence for a cultural shift from materialist to postmaterialist values in Western societies (Inglehart 1997). However, at present, postmaterialist values tend to exist in sub-cultures that are peripheral to mainstream popular culture; the predominant cultural attitude embraces consumption. I will consider different cultural understandings of energy consumption and climate change in Section 4.9.

4.8.2 Australian culture and energy consumption

Wilhite et al (1996) report on a cross-cultural analysis of household energy use behaviour in Japan and Norway and identify significant differences in end use patterns resulting from different cultural practices. Similarly, the IPCC (2001b, p.368) argues that: 'Some aspects of energy-using behaviour may be very hard to change because they play important roles in culture-specific ideals of the good life, varying from country to country'. Ger et al (1998) also identify different consumption practices in different cultures.

It is reasonable to assume, based on the literature cited above, that there are distinctive aspects of Australian culture that influence the magnitude and type of energy consumption in Australia. Riedy and Wilson (2004) identify cultural influences on electricity consumption in Australia but most of the identified influences are associated with migrant groups. I am not aware of any other studies that have sought to link Australian energy consumption patterns to unique cultural characteristics. I will consider some possible cultural influences on energy consumption here, drawing on an exploration of Australian culture by Salt (2001).

Salt (2001) identifies three distinctive Australian cultures: bush culture, suburban culture and beach culture. Bush culture was the first to emerge during Australia's colonisation and development; its symbols are the outback, the bush and the rugged countryside of the 'wide brown land'. Suburban culture emerged during the 20th century as Australians sought a 'quarter-acre block' in the suburbs, a house stocked with appliances and preferably a pool. Beach culture emerged in the latter decades of the 20th century as Australians increasingly moved to settle the vast coastline of Australia.

According to Salt (2001), beach culture is now ascendant, however, I would argue that all three cultures still resonate with the Australian psyche and therefore continue to create particular consumption imperatives. Images of rugged Australian terrain are heavily used in motor vehicle advertisements in Australia, particularly those for four-wheel drive vehicles. The implication is that these vehicles are necessary to cope with the demands of the Australian landscape, despite the fact that most will rarely leave the city. Suburban culture has driven the development of sprawling suburbs around major Australian cities, filled with buildings with poor thermal design and orientation that require substantial air-conditioning in summer to maintain comfort. Beach culture is associated with downshifting and a reduction in consumption, however, the desire to live on the coast has extended commuter belts around cities, increasing demand for transport.

These are just a few examples of possible Australian cultural influences on energy consumption. Further research would be necessary to confirm these influences and identify additional influences.

4.8.3 Creating a culture of climate change response

In Sections 4.8.1 and 4.8.2, I have stressed the ways that a culture of consumption can inhibit climate change response. However, as noted in Section 4.4.4, shared cultural meanings and values can also facilitate climate change response. Moisander (2000, p.148) explores the ways in which 'green consumerism' is socially and culturally mediated and identifies a need for 'exploring, building and introducing new kinds of subject positions for citizens as consumers'. In other words, the development of cultural examples of green consumption can offer individuals an alternative source of identity and group membership to that provided by conspicuous consumption.

There are several examples of policy approaches that draw on, or are consistent with, these insights. In general, these approaches seek to establish a supportive community group to collaboratively pursue sustainable lifestyles. The group provides its members with a source of identity and peer comparison that is oriented towards sustainable, ethical or non-material values, thereby challenging the dominant culture of consumption. Michaelis (2003, p.S142) lists some international examples. In the United States, the Simple Living Network provides support for people wishing to establish study groups (Simplicity Circles) to explore voluntary simplicity and low-consumption lifestyles (The Simple Living Network 2004). In Europe, Global Action Plan has developed several programs to support sustainable consumption, including EcoTeams, which are groups of six households that commit to monitoring their consumption and supporting each other to reduce consumption (Global Action Plan 2004).

In Australia, the Cool Communities program, implemented through a partnership between the AGO and environmental NGOs, provided funding and facilitation support for communities to develop their own GHG abatement programs. The program involved 38 diverse communities, including local councils, education centres, energy-buying groups, schools, church groups and community coalitions (AGO 2004b). Programs like this one have the potential to establish a culture of climate change response, at least locally.

The media can potentially play an important role in the establishment of a culture of climate change response. According to the IPCC (2001b, p.369): 'Raising awareness among media professionals of the need for GHG mitigation and the role of the media in shaping lifestyles and aspirations could be an effective way to encourage a wider cultural shift'. Central to any such shift is the establishment of positive symbolic associations with practices that consume less energy. As Ger et al (1998) point out:

> Unless the image of low impact practices attains the attraction and allure of consumption, that is the symbolism of being joyful, passionate, exciting, fun, sociable, modern, and progressive, not more than a few deliberately alternative consumers will turn to it…[By] relating low impact practices to existing, positive symbolic meanings, there may be opportunities to side-step the rather top-down approach of promoting environmentalism as a value in its own right.

In Australia, the *Your Home* project (Australian Government 2002) is an example of a multimedia approach that seeks to establish the desirability of sustainable housing by linking housing features to improved quality of life and subsuming sustainable design under 'good design'. For example, it stresses the lifestyle benefits of improved natural light and good thermal design in addition to energy and cost savings. Such approaches contribute to the development of a culture of climate change response.

4.9 Climate change discourses

As discussed in Section 2.5.5, a discourse is a shared way of apprehending the world, characterised by particular language, assumptions, metaphors and worldviews. From the perspective of integral methodological pluralism, discourse analysis is a method that identifies cultural structures from a third-person perspective. In this section, I review discourses identified in the literature that are relevant to climate change response. My purpose in this section is to introduce climate change discourses that I will examine in more detail, from an integral perspective, in Chapter 7.

There are many ways to categorise different discourses, some of which I have already mentioned. For example, Cohen et al (1998) define climate change and sustainable development as separate discourses, in need of integration. It is one of my research objectives to contribute to this broad task of integration. However, there is much variation even within the discourses of climate change and sustainable development and this variation is my focus in this section. Thus the discourses discussed here are, for the most part, more specific than the broad discourses of climate change and sustainable development.

In Section 4.9.1, I introduce the general environmental discourses identified by Dryzek (1997). Dryzek is concerned with the historical development of environmental politics, which provides a useful framework from which to approach more specific environmental issues, such as climate change. In Section 4.9.2, I consider grid-group cultural theory and the climate change discourses developed using the theory. This theory has become quite influential in climate policy debate. In Section 4.9.3, I review work on Australian discourse coalitions in the context of climate change policy. Finally, in Section 4.9.4, I consider a sceptical discourse that has strongly influenced public and political perception of climate change and inhibited climate change response.

4.9.1 Dryzek's environmental discourses

Numerous authors have used discourse analysis to explore the way in which environmental issues are framed and understood (e.g. Benton & Short 1999; Dryzek 1997; Milton 1996). While there are numerous ways to classify environmental discourse, I focus specifically on Dryzek's (1997) typology in this section. I have chosen to focus on Dryzek's typology because he adopts a practical political orientation that sits well with my research objectives.

As his starting point, Dryzek (1997, p.12) identifies a 'long-dominant discourse of industrial society', which he labels **industrialism**, that 'may be characterized in terms of its overarching commitment to growth in the quantity of goods and services produced and to the material well-being which that growth brings'. This dominant industrial discourse, which Dryzek also labels **Promethean**, is characterised by a mechanistic view of nature, denial of limits and an emphasis on competition and material self-interest.

Many other authors identify a similar dominant discourse. For example, Jamison (2000, p.251) argues that: 'At the doctrinal, or discursive level, there continues to be an overriding emphasis in most countries on furthering economic growth and international competitiveness'. Similarly, Purser (1997, p.363) argues that: 'Economic growth has become a central social dogma'. He links this dogma to cultural ideals of progress and identifies a 'mechanistic and linear worldview' underpinning modern economies (Purser 1997, p.366). Jacob (2003, p.104) asserts the 'primacy of economic growth' in the specific context of international climate policy negotiations. It is clear that an industrial, growth-focused, mechanistic discourse is widely recognised.

In opposition to industrialism, Dryzek (1997) identifies four categories of environmental discourse, each with a somewhat different interpretation of environmental issues. **Survivalism** is a discourse that warns against the dangers of excessive growth, arguing that humanity is approaching the ecological limits of nature and facing the collapse of natural systems. It contemplates authoritarian responses to environmental problems. **Problem solving** discourses treat environmental issues as problems that can be accommodated through relatively minor adjustments to the existing political economy. These adjustments may include improvements in administration, democratic practices or market operation. **Sustainability** discourses imaginatively attempt to 'dissolve the conflicts between environmental and economic values' by redefining the nature and objectives of development (Dryzek 1997, p.14). **Green radicalism** rejects the basic structure of industrial society, and its consequent ecological impacts, in favour of radical alternatives.

I will return to Dryzek's environmental discourses in Chapter 7, where I will describe each discourse in more detail, interpret their orientation towards energy use and climate change response and include them in an integral theory of discourse.

4.9.2 Discourses derived from grid-group cultural theory

In the specific realm of climate change response, several authors have employed grid-group cultural theory to identify climate policy discourses (Ney & Thompson 2000; Thompson & Rayner 1998a, 1998b; Thompson, Rayner & Ney 1998), their influence on consumption (Dake & Thompson 1999; Douglas et al 1998; Thompson 2000) and their links to collective action (Pendergraft 1998). The work of these grid-group cultural theorists has been influential, appearing in two prominent explorations of the social dimensions of climate change (see Jochem, Sathaye & Bouille 2000; Rayner & Malone 1998) and featuring in the IPCC's TAR (IPCC 2001b, p.372). In this section, I will briefly outline the discourse typology developed by grid-group cultural theorists. I will examine the theoretical basis for this typology and provide detailed discourse descriptions in Chapter 7.

Grid-group cultural theorists identify five types of social grouping or social solidarity: egalitarian, hierarchical, individualistic, fatalistic and autonomous (Thompson, Grendstad & Selle 1999). Briefly, drawing on Thompson, Grendstad and Selle (1999), egalitarians emphasise equality between group members and establish decision-making processes based on active participation and direct consent. Hierarchists require members of the group to conform to socially imposed roles, consistent with their position in the hierarchy. Individualists seek an environment 'free from control by others' in which 'all boundaries are provisional and subject to negotiation' (p.4). Fatalists are 'subject to binding prescriptions' imposed by other solidarities and 'excluded from group membership', giving them little control over their lives (p.5). The autonomous 'hermit' deliberately avoids the coercion inherent in the other four forms of solidarity (p.11).

Each social solidarity exhibits a distinctive cultural bias, including a characteristic myth of nature and, importantly, a characteristic discourse (Thompson & Rayner 1998a). Thompson and Rayner (1998a) consider the different discourse interpretations of climate change. Hierarchists argue that the climate problem is linked primarily to population growth in developing countries. They see nature as tolerant within limits, but perverse if those limits are exceeded. Individualists argue that the climate problem is a result of market failure and inappropriate pricing. They see nature as benign and robust. Egalitarians argue that the climate problem stems from profligacy in developed countries. They see nature as ephemeral and fragile. Fatalists and hermits do not participate in policy processes, either because they are excluded, or because they choose not to participate.

Thompson and Rayner (1998a) argue that the three participating discourses (hierarchical, egalitarian and individualist) exist in a dynamic relationship in which alliances and relative strengths continually change, but the discourses themselves remain stable. Further, grid-group cultural theorists contend that each discourse is essential to the viability of the others. While the influence of each discourse can change over time, there is no developmental aspect to this change. Rather, particular discourses may become dominant at particular points in time, before waning again, and perhaps returning to prominence at a later time. Here, grid-group cultural theory differs from integral theory, which embeds any short-term variation in the balance between discourses in a long-term developmental perspective. In Chapter 7, I will consider ways in which these conflicting theories might be integrated.

4.9.3 Discourse coalitions in Australia

Bulkeley (2000b) provides another perspective on climate change discourse, focusing specifically on Australian climate policy. Bulkeley (2000b) draws on Hajer's (e.g. 1995) concept of **discourse coalitions** to make sense of Australian climate policy processes. Discourse coalitions 'comprise sets of storylines, the actors who adhere to and articulate such storylines, and practices that are consistent with the storylines' (Bulkeley 2000b, p.734). Thus defined, discourse coalitions incorporate not only discourses in the cultural quadrant but also practices and institutions from the systemic quadrant. Importantly, actors do not need to share common interests and goals to be part of a discourse coalition: 'story-lines, not interests, form the basis of the coalition' (Hajer 1995, p.66). What members of a discourse coalition have in common is 'a shared understanding of the policy problem' (Bulkeley 2000b, p.734).

Bulkeley (2000b) identifies two Australian climate change discourse coalitions. The first is a resource-based discourse coalition that emphasises:

> …the need to act in the (economic) national interest, to ensure that developing countries participate in any international agreement, and, in the light of scientific uncertainty and the potential costs of action, to pursue measures which have a minimal economic impact (Bulkeley 2000b, p.739).

This coalition stresses the reliance of the Australian economy on resources, including fossil fuel energy resources. According to Bulkeley (2000b), its members include scientific sceptics, the Department of Foreign Affairs and Trade, the Department of Primary Industries and Energy (now DITR), ABARE and various industry groups, including the Business Council of Australia, the Electricity Supply Association of Australia and the Australian Coal Association.

The second is a greenhouse action discourse coalition whose members have diverse interests but who share a commitment to a precautionary response to climate change (Bulkeley 2000b, p.739). According to Bulkeley (2000b), members of this discourse coalition include the Department of Environment, Sport and Territories (now DEH), environmental NGOs, the Sustainable Energy Industry Network of Australia (now the BCSE) and the Australian Medical Association. Though these members have very different reasons for urging a precautionary approach, they form a shared storyline in order to influence policy. I will draw on the discourse coalition concept in Chapters 5 and 7.

4.9.4 A discourse of scepticism

A climate change discourse not specifically identified by the authors discussed above, but particularly important to public and political perception of climate change, is a persistent discourse of scepticism. Despite the IPCC's clear assessment that climate change is occurring and that human actions are partly responsible there is a small group of sceptics that continues to question climate science (e.g. Bellamy 2004; Lomborg 2001). A peer review process involving hundreds of scientists backs the IPCC's assessment (Schneider 2002). In contrast, the claims of climate sceptics are rarely peer reviewed before release and are rapidly discredited when they are subjected to review. For example, Monbiot (2004) thoroughly critiques Bellamy (2004) and Schneider (2002) thoroughly critiques Lomborg (2001).

While I am convinced that the claims of climate sceptics lack credibility, the discourse of scepticism persists and continues to influence public and political debate. One of the reasons for this persistence is the role of various interest groups, generally associated with fossil fuel industries, in promoting the work of climate sceptics and emphasising the uncertain aspects of climate science. This is exacerbated by a misunderstanding of science as a process supposed to provide objective certainty. According to Norgaard (2004, p.240): 'Scientists as a whole do not understand how climate science works [and the]…public has proven very vulnerable to special interests appealing to simpler understandings of how science works to convince the public that climate science is not science'.

Media presentation of climate science and policy also contributes to the persistence of a sceptical discourse. The media typically emphasises controversy and scientific uncertainty, presumably because these conflictual issues are perceived as more newsworthy. While conflict over climate science and policy is very real, the media tends to give the sceptical positions promoted by a small minority as much weight as the work of the IPCC, backed by hundreds of scientists. According to Melissa Fyfe, an Environment Reporter at *The Age*:

> In the pursuit of balance, climate change sceptics are so often approached for comment it seems like there is a 50-50 split of scientific opinion. In fact, there are a handful of sceptics and thousands of scientists around the world who are not (quoted in Urban 2004).

The equal weight given to comments from climate sceptics fosters public and political uncertainty over climate change.

The discourse of scepticism has been, and remains, an important barrier to climate change response. However, in most countries, political leaders now accept the reality of climate change and debate has moved on to the details of an effective response. One of the important considerations in determining the details of the response to climate change is ethics. In the next section, I will consider the ethics of climate change response.

4.10 The ethics of climate change response

According to Inayatullah (2002b, p.301): 'Ethics is a call for finding some shared meanings in a fractured world'. The cultural quadrant is the realm of shared meaning and it is in a review of that quadrant that ethics is appropriately considered. The nature of the human response to climate change has important ethical implications that have received much attention in the literature (e.g. Byrne et al 1998; Meyer 2000; Najam et al 2003; Parry et al 2001; Pinguelli-Rosa & Munasinghe 2002; Singer 2002; Spash 2002). Inayatullah's (2002b, p.300) reminder that: 'Alternatives cannot be morally neutral' is very much applicable to the alternatives presented in the international climate policy debate.

In this section, I will outline the main ethical issues raised in the literature and some of the policy solutions proposed to promote a more equitable response to climate change. In Section 4.10.1, I review ethical principles that have been proposed to guide the assignment of responsibility for climate change response. These principles are central to debates over the Kyoto Protocol and the question of appropriate participation in future international agreements. In Section 4.10.2, I consider the relationship between climate change response and intergenerational equity. Finally, in Section 4.10.3, I discuss principles for identifying an ethical GHG abatement target.

4.10.1 Ethical principles for responsibility and participation

Climate change is a global problem that requires a global response. Eventually, this response will require participation by all nations, developed or developing. Much of the ethical debate in international negotiations centres on how responsibility for climate change response should be distributed across nations (IPCC 2001b, p.86). Currently, the first principle of the FCCC is quite clear on this matter:

> The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof (United Nations 1992b, Article 3).

That is, because developed nations have contributed most of the anthropogenic GHG emissions to date and have the wealth to respond effectively, those nations should be the first to reduce GHG emissions. This principle is embodied in the Kyoto Protocol, which only sets binding GHG emission targets for developed nations. Developing countries have indicated their unwillingness to participate in any future agreement that caps their emissions unless their equity concerns are addressed (Müller 2002).

Despite the clear ethical position established by the FCCC, which has been ratified by 189 Parties, debate continues over the appropriate ethical principles to apply to questions of responsibility and participation. Australia, for example, has based its rejection of the KP at least partly on the exclusion of developing countries (e.g. DPMC 2004, p.24). The IPCC (2001b, p.90) has classified theoretical and philosophical approaches to ethical concerns in international climate policy negotiations into four 'alternative views, based on: rights, liability, poverty, and opportunity'. In addition, Singer (2002) considers four separate ethical principles for allocating responsibility for climate change response. I will summarise the alternative positions below.

Rights-based

This approach to ethical distribution 'is based on equal (or otherwise defensible) rights to the global commons' (IPCC 2001b, p.90). Most commonly, this type of approach assumes an equal right to the atmospheric sink, expressed as an equal per capita entitlement to GHG emissions (e.g. Byrne et al 1998; Meyer 2000; Singer 2002). However, other ways of allocating rights, based on geographical area, historic emissions and economic activity have been considered (IPCC 2001b, p.90).

A prominent proposal for a rights-based approach to international participation in climate change response is the 'contraction and convergence' (C&C) model, originally proposed by Aubrey Meyer and the Global Commons Institute (GCI) (Meyer 1999, 2000). The C&C model 'defines emission permits on the basis of a convergence of per capita emissions under a contracting global emission profile' (Berk & den Elzen 2001, p.466). That is, per capita emissions in all nations would converge on an agreed global GHG emissions target by an agreed date. Both the target and date would need to be negotiated, which could be difficult given the lack of consensus on an appropriate target atmospheric GHG concentration (see Section 3.6.2). Most implementation models tie national emission rights to the national population in a particular year, so that there is an incentive for population control as well as per capita emission control (Byrne et al 1998; Singer 2002).

Emission rights would be tradable, which introduces an additional way to improve equity. Per capita emissions from developed nations are substantially higher than those from developing nations. Carbon dioxide emissions in the developing world average 2.2 tonnes per person per year, whereas developed country emissions range from 5.9 to 18.3 tonnes per person per year (Singer 2002, p.35). Consequently, developing countries would likely have excess permits that they could trade to developed countries as well as some scope to increase their emissions as they develop. Australia, with the highest per-capita GHG emissions in the world (Turton 2004), would almost certainly need to purchase permits.

The C&C model seeks 'simultaneously to reward restraint, punish profligacy, provide incentives for conservation, induce a transfer from rich countries to poor ones, and thus lead to distributional equity, efficiency, and sustainability' (IPCC 2001b, p.91). After considering other ethical principles, Singer (2002, p.43) supports a per-capita rights-based approach 'because of its simplicity, and hence its suitability as a political compromise, and because it seems likely to increase global welfare'.

Liability-based

Liability-based approaches assert 'the right of people not to be harmed by others' actions without suitable compensation', focus 'on the damage caused by overuse of the commons, and [seek] to establish mechanisms through which those who cause such damage are penalized and the victims of the damage compensated' (IPCC 2001b, p.91). In other words, liability-based approaches apply the polluter pays principle (Singer 2002).

Historically, the major proportion of anthropogenic GHG emissions has come from the developed countries. Indeed, the economic advantages of the developed countries have been achieved, in part, through an uncompensated expropriation of the atmospheric resource that belongs equally to all of humanity. Despite the fact that many more people live in developing countries, the total contribution of developed nations to the stock of GHGs in the atmosphere will continue to exceed that from the developing nations until around 2038 on current trends (Singer 2002, p.33). Thus, Singer (2002, pp.33-34) concludes: 'If we believe that people should contribute to fixing something in proportion to their responsibility for breaking it, then the developed nations owe it to the rest of the world to fix the problem with the atmosphere'. Although the justification is different, the outcome is the same as that for the rights-based approach; the developed countries must take first responsibility for responding to climate change.

Poverty-based

The poverty-based approach recognises 'the need to protect the poor and vulnerable against the impact of climate change as well as climate policy' (IPCC 2001b, p.91). Poor and vulnerable communities lack the flexibility and resources to respond or adapt to climate change or international policy changes. Poverty-based approaches to ethics advocate investment in 'capacity building and protection for the poor and vulnerable' as well as transfer of low-emission technologies, such as renewable energy (IPCC 2001b, p.91).

Singer (2002) considers two ethical principles that I would classify as poverty-based principles. The first is a principle 'that requires us to distribute resources so as to improve the level of the worst-off' (Singer 2002, p.40). This principle is advocated by the philosopher John Rawls in *A Theory of Justice* (Rawls [1972] 1999). Rawls argues that 'we can only justify giving more to those who are already well off if this will improve the position of those who are worst off' (Singer 2002, p.37). Singer (2002, p.40) concludes that, 'given the huge resource gap between rich and poor nations' this principle requires the 'rich nations [to] bear all of the costs of the required changes'. The second principle is a utilitarian principle that expresses a preference for the proposal that 'would lead to the greatest net happiness for all affected' (Singer 2002, p.40). Singer notes that, from a utilitarian perspective, a small transfer of wealth from developed to developing countries will improve developing country welfare far more than it will reduce developed country welfare and should therefore be supported.

There are some mechanisms within the existing global climate policy regime that are consistent with a poverty-based approach, including financial support for developing nations to monitor and report on GHG emissions and the Clean Development Mechanism (CDM) that allows developed nations to meet their obligations under the KP through cooperative investment in GHG emission reduction in developing nations (IPCC 2001b, pp.91-92).

Opportunity-based

The fourth ethical approach identified by the IPCC is opportunity-based, centred on 'the right of people…to the opportunity to achieve a standard of living enjoyed by those with greater access to the commons' (IPCC 2001b, p.91). This approach is closest to the one actually adopted in the FCCC and KP, which seeks to avoid 'large financial transfers or windfall gains', 'sudden shocks', any 'financial burden on non-Annex I countries' and 'restrictions on the space for sustainable development' (IPCC 2001b, p.91). This approach recognises that developing nations should have the opportunity to develop and therefore places the burden of climate change response on developed nations. In this, it is consistent with all the ethical principles considered here. In other words, there are no ethical grounds for an argument that developing nations should accept binding GHG emission targets under the KP. Any such argument is purely interest-based.

4.10.2 Intergenerational equity

The ethical principles discussed above are concerned primarily with equity between nations, although most could also be applied to questions of distributional equity within nations. However, climate change also raises questions of intergenerational equity and ethics (Spash 2002). Intergenerational equity requires the present generation to 'recognize and protect' the right of future generations 'to enjoy at least the same capacity of economic and ecological resources that present generations enjoy' (Padilla 2002, p.81). Most of the impacts of climate change will be experienced by future generations, whereas past and present generations are responsible for creating the problem. Further, the cost of responding to climate change is largely experienced by the present generation. Thus the magnitude and timing of climate change response has implications for intergenerational equity. If GHG emissions are cut too fast, or too deeply, the present generation will bear a disproportionate burden of the cost of responding. If GHG emissions are cut too slowly, or too shallowly, future generations are deprived of their right to a stable atmosphere and may be significantly harmed by the impacts of climate change.

There are several ethical dilemmas to address in determining the timing and magnitude of climate change response. First, the expected future impacts of climate change include loss of human life, forced human migration and diminished biodiversity. Valuation of such impacts is controversial (Spash 2002, p.20). What is the value of a human life, or the existence of another species? Is the value the same in different parts of the world? The non-market valuation methods discussed in Section 3.7.2 can provide monetary estimates of these impacts, but they do not address the question of whether such monetisation is appropriate or desirable. As stated in Section 3.7.2, money cannot buy a human life or a stable climate.

Second, there is a problem with 'the idea that people today can ethically determine the value of natural wonders and integral ecosystems to future generations, as this violates democratic principles' (Birkeland, Dodds & Hamilton 1997, p.145). Estimates made today impose arbitrary time preferences on people that may not share those preferences and have no political power to defend their preferences (Padilla 2002). There are also problems with the application of a discount rate, which reflects a mortal individual's time preference for consumption, to a society that is effectively immortal (van den Bergh 2004). As there is no way to determine what value future generations will place on natural systems, there is an ethical imperative to ensure that opportunities for future generations are not diminished through destruction of these systems.

Third, the practice of discounting in economic analysis devalues the future costs of climate change so that large future impacts appear very small in the present (IPCC 2001b, p.466; Padilla 2002). Consequently, there is little apparent economic incentive for the present generation to respond to climate change; the burden of climate change response is shifted, unfairly, onto future generations (Padilla 2002). Discounting of future climate change impacts is sometimes defended on the basis that future generations will be better placed to reduce the costs of climate change, as technological development will have provided cheaper abatement options than those available today. However, this argument fails to consider the lag in the response of the climate system to current GHG emissions. By the time the costs of climate change are felt, it is too late to abate the emissions that caused them. On this basis, 'the use of discounting to reduce distant values asymptotically to zero appears morally vacuous' (Spash 2002, p.19).

4.10.3 An ethical abatement target

In Section 3.7.2, I followed Toth (2000) in arguing that, given that the future impacts of climate change are uncertain but potentially severe, it is appropriate to use methods other than economic analysis to determine whether to respond to climate change. Economics cannot adequately account for equity between nations (IPCC 2001a, p.125) or between generations (Spash 1994). Thus: 'Recourse to ethical principles clearly is in order' (IPCC 2001a, p.125). This argument applies not only to the question of whether or not to respond to climate change, but also to decisions on the timing and magnitude of climate change response.

The first ethical principle I would advocate is one of democratic participation in decision-making. Participation is widely recognised as a core value of sustainable development and democracy, and is therefore worthy of advocacy for normative reasons. In addition, participation in development and application of ethical principles to climate change response will improve the likelihood that these principles are shared and that particular ethical values are not imposed on those who do not share them. I will consider collective decision-making processes in more detail in Section 4.11.

The second ethical principle that is relevant here is the precautionary principle, discussed in Section 1.3.2. The future impacts of climate change and the value placed on a stable climate by future generations are both uncertain. However, it is clear that there is a risk of severe impacts on future generations. A precautionary approach requires the present generation to establish a GHG abatement target that will protect the opportunities of future generations and their right to a stable climate. As discussed in Section 3.6.2, I believe that stabilisation of the atmospheric concentration of CO_2 at 450 ppmv is a target that strikes an appropriate balance between the needs of present and future generations. Others may advocate different targets, which again emphasises the need for participatory decision-making processes.

In Appendix C, I have examined the implications of a 450 ppmv target for Australia. Assuming implementation via a C&C model with full international participation, my analysis indicates that Australia would need to achieve emission reductions of at least 60 per cent by 2050 and as much as 90 per cent by 2100. Some of this reduction could be achieved through international emissions trading.

4.11 Collective decision-making

The final cultural perspective I will consider in this chapter relates to the collective processes used to decide on climate change response and related issues of economic development, ecological sustainability and social equity. There are many ways in which collective decisions can be made, with varying degrees of participation. The study of these decision-making processes is the realm of political science. Since Australia is constituted as a democracy, democratic theory is also relevant. In this section, I draw on political science and democratic theory to outline actual and proposed decision-making processes of relevance to Australian climate policy.

I have already discussed many of the scientific and economic tools that support decision-making processes (see particularly Sections 3.6.2, 3.5.4 and 3.7.2). In Chapter 5, I will review some specific tools used to support policy development in Australia. Here, I am more interested in the discursive element of decision-making processes, and the extent to which different processes include diverse discourses. Nevertheless, I also discuss the institutional embodiment of decision-making processes where appropriate. In Section 4.11.1, I give a brief account of post-normal science, which is recognised by the IPCC (2001b, p.649) as having direct relevance to decision-making processes for climate change and sustainable development. In Section 4.11.2, I discuss decision-making in liberal democracies, drawing primarily on Dryzek (2000). In Section 4.11.3, I consider forms of public participation that extend beyond voting. Finally, in Section 4.11.4, I introduce an emerging theory and practice of deliberative democracy that is central to the integral response to climate change I propose in Chapter 8.

4.11.1 Post-normal science

Funtowicz and Ravetz (1993, p.739) argue that a new **post-normal science** is emerging 'in response to the challenges of policy issues of risk and the environment'. They argue that post-normal science is needed when uncertainties and decision stakes are high. Climate change, as a policy issue that involves risk, the environment, deep uncertainty and high decision stakes, is the kind of problem that Funtowicz and Ravetz have in mind. The IPCC (2001b, p.649) specifically recognises the relevance of post-normal science for climate policy decisions. I will briefly summarise relevant aspects here.

Funtowicz and Ravetz proposed the term **post-normal** as an alternative to **postmodern**, influenced by Kuhn's ([1962] 1996) description of normal science as the 'routine puzzle solving by which science advances steadily between its conceptual revolutions' (Funtowicz & Ravetz 1993, p.740). The term refers to an epoch or approach rather than a specific method. Post-normal science is more accepting of uncertainty and the presence of subjective values, seeking to manage these instead of ignoring them. It is issue-driven, proceeds through interactive dialogue and engages in reflection on its role in history and the future (Funtowicz & Ravetz 1993). Crucially, post-normal science recognises that: 'When science is applied to policy issues, it cannot provide certainty for policy recommendations; and the conflicting values in any decision process cannot be ignored even in the problem-solving work itself' (Funtowicz & Ravetz 1993, p.740). Thus, from the perspective of post-normal science, the IPCC's pursuit of policy neutrality in its scientific assessment work (see Section 3.2.1) is futile.

Not all situations call for post-normal science. When uncertainty and decision stakes are low, applied science or professional consultancy offer adequate problem-solving responses. However, when there is deep uncertainty 'of the epistemological or the ethical kind, or when decision stakes reflect conflicting purposes among stakeholders', post-normal science is appropriate (Funtowicz & Ravetz 1993, p.750). Funtowicz and Ravetz (1993, p.752) argue that 'resolution of policy issues in post-normal science involves the inclusion of an ever-growing set of legitimate participants in the process of quality assurance of the scientific inputs'. These **extended peer communities** may include, in the case of climate change, people likely to be impacted by the changing climate, as well as those impacted by policy responses. As Ravetz (1999, p.652) puts it, 'local people can imagine solutions and reformulate problems in ways for which the accredited experts, with the best will in the world, are not prepared'. The extension of valid scientific involvement outside the realm of so-called experts is seen as offering not only ethical improvements, but also practical improvements through greater access to distributed knowledge and different types of knowledge – what Funtowicz and Ravetz (1993, p.753) call **extended facts**.

At present, post-normal science is a normative ideal rather than a practical reality, at least in the case of climate policy. There are few opportunities for citizens to have substantive input to climate policy decisions. Indeed, I will argue in the next section that citizens have minimal input to decision-making in liberal democracies in general. Further, there is an apparent reluctance on the part of the IPCC to depart from the 'normal' mode of scientific assessment. Sections 4.11.3 and 4.11.4 consider participatory processes that could support the engagement of extended peer communities and extended facts in climate policy decisions.

4.11.2 Liberal democracy

Before considering participatory forms of democracy of the type necessary for conducting post-normal science, it is important to first consider how political decisions are made at present. Australia is a liberal democracy, committed to the twin doctrines of liberalism and democracy. Dryzek (2000, p.9) describes liberal democracy as 'the world's dominant political ideology'. Liberalism starts with 'the assumption that individuals are mostly motivated by self-interest rather than any conception of the common good, and that they themselves are the best judges of what this self-interest entails' (Dryzek 2000, p.9). For liberals, the market is the first place in which the interests of different individuals can, and should, be reconciled. Politics comes into play when these interests cannot be reconciled to the mutual benefit of the individuals involved. Liberal politics is guided by a constitution that establishes rules, rights and obligations for 'reconciliation and aggregation of predetermined interests' (Dryzek 2000, p.9).

The degree of democratic participation in a liberal democracy can vary widely, depending on the nature of the compromise established between liberalism and democracy. Liberalism does not, in itself, require any democratic participation. While constitutions institutionalise democracy, the practice of democracy is constrained by 'dominant discourses and ideologies, often intertwined with structural economic forces…[that impose] severe constraints on what is possible in terms of both the content of public policy and the degree of democracy that can be tolerated in the state's production of policy' (Dryzek 2000, p.21).

Processes of democratisation can counter these constraints. Dryzek (2000, p.29) argues that democratisation occurs as extension along any one of three dimensions:

> The first is franchise, expansion of the number of people capable of participating effectively in collective decision. The second is scope, bringing more issues and areas of life potentially under democratic control…The third is the authenticity of the control…[that is,] to be real rather than symbolic, involving the effective participation of autonomous and competent actors.

While extension along the first two dimensions is possible within a liberal democracy, Dryzek (2000, p.29) argues that extension along the third dimension is difficult, given the imperative for states to 'maintain the confidence of actual and potential investors' and avoid the indeterminacy that authentic democratic participation introduces. This leads Dryzek to advocate an alternative, deliberative model of democracy, discussed in Section 4.11.4.

Central to existing liberal democracies is the assumption, supported by rational choice theory and social choice theory, 'that individual preferences do not change in the process of social or political interaction' (Dryzek 2000, p.34). For rational choice theorists, individuals are 'concerned only with maximising a set of predefined elements in a utility function (which might include income, wealth, pleasant leisure time, etc.)' (Dryzek 2000, pp.31-32). If this assumption is accepted, the challenge for political theory becomes how to aggregate these predefined elements or preferences into collective decisions.

In Australia, and other liberal democracies, aggregation of preferences takes place primarily through voting in elections and referenda. This is a minimal form of public participation that cedes control over ongoing decision-making to the government of the day. Voting in elections only allows citizens to express their preference for one of the particular candidates or parties on offer. It does not allow them to express their specific preferences in relation to discrete policy issues or decision. Further, social choice theorists argue that voting mechanisms are subject to strategic manipulation and different mechanisms will always yield different results, making voting meaningless and arbitrary (Dryzek 2000). The limitations of voting provide an incentive to contemplate other forms of public participation in decision-making. I will consider some forms that participation can take in the next two sections.

4.11.3 Public participation

Given the calls for greater public participation in a post-normal science, and the evident limitations of liberal democracy, there has been much attention to forms of public participation in decision-making generally (e.g. Bishop & Davis 2002; Carson & Gelber 2001; Catt & Murphy 2003; Font 2002; Renn et al 1993), and in the specific case of climate policy (e.g. Kasemir et al 2003b; van den Hove 2000). The International Association for Public Participation (IAP2 2000) has developed a well-known spectrum of public participation that identifies five categories of participation with increasing degrees of public engagement and impact:

- Inform: the objective is to keep the public informed by providing balanced information to help citizens understand problems, alternatives and solutions
- Consult: the objective is to seek public feedback on analysis, alternatives and/or decisions
- Involve: the objective is to work directly with the public to ensure issues and concerns are understood and considered
- Collaborate: the objective is partnership with the public in all aspects of decision-making
- Empower: the objective is to cede control over decision-making to the public.

Bishop and Davis (2002) review several alternative typologies of public participation in policy and argue that the different types of participation should not be characterised as positions on a continuous spectrum of increasing participation. Instead, they argue that 'policy participation is best understood as a discontinuous set of techniques, chosen according to the issue in hand and the political imperative of the times' (Bishop & Davis 2002, p.26). They identify five participation types:

- Consultation: 'to gauge community reaction to a proposal and invite feedback'
- Partnership: 'involving citizens and interest groups in aspects of government decision-making'
- Standing: 'allowing third parties to become involved in the review process'
- Consumer choice: 'allowing customer preferences to shape a service through choices of products and providers'
- Control: 'to hand control of an issue to the electorate' (Bishop & Davis 2002, p.27).

While there are clear parallels with the IAP2 spectrum (e.g. consult parallels consultation, collaborate parallels partnership, empower parallels control) there are also different types of participation, particularly the idea of participation through consumer choice.

Catt and Murphy (2003) provide a third typology based on the role of the participants and how they are chosen. The role of participants may be to synthesise, contest or provide information. Within these three categories, participants may be elected, self-appointed, selected (by the government or some other organisation) or randomly selected. This gives twelve categories of participation.

These (and other) typologies of participation are useful for locating existing and proposed decision-making processes. The IPCC (2001b, p.651) sees public participation in decision-making as a way to 'inform and educate the public, incorporate public values, assumptions, and preferences into decision-making, increase the substantive quality of decisions, foster trust in institutions, and reduce conflict among stakeholders'. The IPCC's view is notable for its continued emphasis on decision-making by central authorities. There is certainly no contemplation of the type of empowering or collaborative public participation included in the IAP2 spectrum or the partnership or control techniques identified by Bishop and Davis (2002). In Chapter 5, I critically examine energy and climate policy development processes in Australia and conclude that they do little more than inform and consult the Australian public.

There are two reasons for promoting policy development processes that contemplate greater public engagement and empowerment. First, and this is particularly important in the context of the integral theory of development, democratic participation has been linked to self-transformation (Dryzek 2000; O'Neill 2002; Poncelet 2001; Warren 1992). The process of participation can empower, lead to transformation of preferences and encourage the development of civic values.[38] Thus, participatory engagement may offer a pathway to the kind of personal development contemplated by integral theorists as a response to the civilisational challenges discussed in Section 1.2. I will explore this idea in Chapter 8. Second, participatory decision-making processes can deliver better decisions by providing access to a broader knowledge base (the extended peer community of post-normal science, with its extended facts), building links and trust between experts and the public, improving problem definition, 'preventing [or reducing] implementation problems, establishing commitment among stakeholders and increasing the democratic content' (Bulkeley & Mol 2003, p.151).

An interesting question for participatory decision-making is how to balance inputs from the public, experts and stakeholders. Here, the cooperative discourse model proposed by Renn et al (1993) and elaborated by Renn (1999) is useful. The cooperative discourse model comprises three steps:

1. Identification and selection of concerns and evaluative criteria.
2. Identification and measurement of impacts of the different decision options.
3. Aggregation and weighting of expected impacts by randomly selected citizens and elicitation of citizens' preferences (Renn et al 1993, pp.190-191).

At each step, there is involvement by interest groups, experts and citizens. However, interest groups are most involved in the first step, experts in the second and citizens in the third. The rationale for involving each different group is the need for 'integrating analytic reasoning with

[38] As Dryzek (2000, p.63) points out, this strand in democratic thinking stretches back to John Stuart Mill, who wrote about the individual and social benefits of democratic participation in his essay *On Liberty* (Mill [1859] 2001).

deliberation and interpretation' (Renn 1999, p.3049). I will return to this model in Chapter 8. In the next section, I consider the role of democratic participation in the context of the emerging theory of deliberative democracy.

4.11.4 Deliberative democracy

According to Dryzek (2000, p.1):

> The final decade of the second millennium saw the theory of democracy take a strong deliberative turn. Increasingly, democratic legitimacy came to be seen in terms of the ability or opportunity to participate in effective deliberation on the part of those subject to collective decisions…The deliberative turn represents a renewed concern with the authenticity of democracy: the degree to which democratic control is substantive rather than symbolic, and engaged by competent citizens.

It is the emerging theory and practice of deliberative democracy that is my topic in this section. The literature on deliberative democracy has grown rapidly (e.g. Bohman 1998; Chambers 2003; Dryzek 1990; Dryzek 2000; Gundersen 1995; Habermas 1996). I draw on this literature selectively here, seeking a theory of deliberative democracy that takes into account the competing discourses discussed in Section 4.9.

At the heart of deliberative democracy is the process of individual and social deliberation. Gundersen (1995, pp.11-16) describes deliberation as an active process of challenging unconsidered beliefs and values, encouraging individuals to arrive at a defensible position on an issue. For Dryzek (2000, p.1), it is a non-coercive, reflective and pluralistic process, allowing 'argument, rhetoric, humour, emotion, testimony or storytelling, and gossip', through which people arrive at a particular judgement, preference or view. Crucially, people may change their views and preferences during deliberation. This is a clear point of departure from liberal theories of individual and collective decision-making, which assume that preferences are fixed.

Dryzek (2000) identifies two main strands of deliberative democracy. The first is a liberal constitutionalist form, which confines deliberation to the existing institutions of liberal democracy and the state. The state here is defined as 'the set of individuals and organizations legally authorised to make binding decisions for a society' (Dryzek 2000, p.82). The second strand, which he labels **discursive democracy**, adopts a more critical orientation towards existing institutions. It can occur within the state, but also occupies the broader sphere of civil society, extending beyond state boundaries and even beyond the human world. This is the strand that Dryzek advocates (Dryzek 1990, 2000) and, given the important role of discourse in the cultural quadrant (see Sections 2.5.5 and 4.9), it is primarily this discursive strand of deliberative democracy that I am interested in here.

Deliberative democracy strives for democratic authenticity, which Dryzek (2000, p.8) describes as 'the degree to which democratic control is engaged through communication that encourages reflection upon preferences without coercion'. Thus, those that wish to promote deliberative democracy must consider power relations that can lead to coercion and the extent to which citizens and other political actors possess 'equality of deliberative competence' (Dryzek 2000, p.8). A particular problem for deliberative democracy is 'inequality between the voice of business and the voices of everybody else' in policy development (Dryzek 2000, p.18). Deliberative democracy adopts a critical stance that seeks to identify and counter dominant ideologies and structural forces that constrain the exercise of authentic democracy.

Dryzek (2000, p.18) argues that 'the contestation of discourses is a vital part of deliberative democracy' and that 'argument always has to be central to deliberative democracy' (p.71). Discursive democracy is necessarily social and interactive, as it is only through social engagement that different discourses can emerge and enter into contestation. Political interaction and contestation is essential to provide the challenge to unconsidered views stressed by Gundersen (1995); contestation induces reflection (Dryzek 2000, p.76). In a deliberative approach, decisions are made 'through reasoned agreement rather than voting' (Dryzek 2000, p.47). Reasoned agreement does not correspond to consensus, as different actors may have very different reasons for supporting a decision (Dryzek 2000, p.49). Bulkeley (2000b) makes a similar point in her discussion of discourse coalitions (see Section 4.9.3).

Although discursive contestation can take place outside the state – indeed, Dryzek argues that it is often preferable that it does – transmission of the results of such contestation to the state is still required, as 'the state remains the main…entity for making enforceable collective decisions in response to social problems' (Dryzek 2000, p.81). Many mechanisms have been proposed or trialled to transmit the results of deliberation to decision-making bodies within the state. Dryzek (2000, p.54) sees discourse and rhetoric in the public sphere as the mechanism of transmission to the state. Fishkin (1995) discusses the use of deliberative opinion polls, which poll citizens on their position on an issue after they have engaged in a deliberative process. Eight such polls have been conducted in Texas as an input to local and regional energy policy and investment decisions (Fishkin & Luskin 2004). Other approaches include citizens' juries (e.g. Carson et al 2002) and consensus conferences (Einsiedel, Jelsoe & Breck 2001).

The mechanisms discussed above have so far been implemented primarily as one-off processes with little lasting impact on institutions. Several authors emphasise the need to establish institutions that promote deliberation and discursive dialogue on a routine basis (e.g. Connor & Dovers 2004; Healy 2003). Connor and Dovers (2004, pp.206-208) argue that concrete institutions for discursive dialogue on the nature of sustainable development, such as National Councils for Sustainable Development (NCSDs), should be established under the auspices of the state. Climate change would clearly be a high priority issue for an NCSD, or a similar deliberative forum, to consider.

Part C. Towards an integral climate change response

Over the last two chapters, I have used the quadrants of integral theory to structure my literature review. In this final part of the literature review, I assess progress towards an integral understanding of climate change response. In Section 4.12, I critically review two methods, not considered elsewhere in the literature review, that claim to achieve integration: integrated assessment and integrated resource planning. Finally, in Section 4.13, I discuss the conclusions of the literature review with reference to my research questions and the objectives discussed in Section 3.1.1.

4.12 Methods that claim integration

In this section, I consider two methods that claim, in name and objective, to achieve some degree of integration. My purpose is to assess the integration actually achieved by these methods within the framework provided by integral theory. I consider integrated assessment in Section 4.12.1 and integrated resource planning in Section 4.12.2.

4.12.1 Integrated assessment

Integrated assessment is an approach that attempts to draw together and coherently synthesise information from a wide range of disciplines to meet the needs of policy and decision makers and provide insights that would not be apparent from any single disciplinary perspective (IPCC 2001a, p.118; Schneider 1997). According to Schneider (1997, p.245): ‘Integrated assessment models are the primary analytical tools now available to study the connected physical, biological, and social components of global change problems created by hypothetical global change disturbances’. By aspiring to include the social dimension, broadly defined, integrated assessment seeks the kind of integration proposed by integral theorists.

Integrated assessment is a branch within an emerging **sustainability science** (Kasemir et al 2003b). Sustainability science is science in service of the transition to sustainability, focused on the ‘complex dynamic interactions between social, environmental and economic issues’ (Kasemir, Jaeger & Jäger 2003, p.3). It is a post-normal science that seeks integration of complex natural and human systems. Integrated assessment is typically understood as the modelling and assessment branch of sustainability science (e.g. Kasemir et al 2003b).

One of the problems with any review of integrated assessment is the sheer variety of modelling and assessment approaches that lay claim to the name, including those seeking integration of systemic computer models, those seeking to develop an interface between models and the public through simulation gaming and participatory assessment (e.g. Kasemir et al 2003b; Robinson 2003) and those attempting to transparently incorporate modeller subjectivity (Schneider 1997). Schneider (1997, p.232) identifies five overlapping generations of integrated climatic impact and policy assessments; it is only in the fifth, of which there are few (if any) examples, that changing value systems are explicitly considered and surprises to social systems and values are explored. Most integrated assessments do not consider subjectivity and do not make value systems explicit. In other words, the actual extent of the integration achieved in integrated assessment models typically falls well short of what is envisaged by integral theory.

This situation is more reflective of the state of the art of integrated assessment than any theoretical limitation of the approach. Traditionally, the field of integrated assessment has largely focused on the technical task of computer model integration within the systemic quadrant (Kasemir, Jaeger & Jäger 2003). However, the field is certainly striving towards broader integration and at least some participants in the field are aware of the need for explicit consideration of subjectivity (Parker et al 2002; Schneider 1997), greater attention to ethical concerns (Bürgenmeier 2003) and public participation in assessment processes (Jäger 1998; Kasemir et al 2003b). It is clear that existing work on integrated assessment provides a strong foundation for an integral climate change response. However, better integration will not be achieved by better modelling, but by improving the interface between decision-makers, the public and all stages of the modelling process. I will return to this point in Chapter 8.

4.12.2 Integrated resource planning

In the 1970s, an approach to energy sector economic evaluation called **least cost planning** (LCP) emerged in the United States (Mills 2001). Traditional electricity planning 'sought to expand supply resources to meet anticipated demand growth with very high reliability, and to minimize the economic cost of this expansion' (Swisher, Jannuzzi & Redlinger 1997, p.17). LCP was an attempt to treat demand-side and supply-side options for meeting increases in energy demand equally. In an LCP approach, a comprehensive suite of demand management and supply options is analysed to identify the least cost mix of options to maintain energy supply. Often, given the high cost of augmenting network infrastructure, demand management options are a more cost effective way to maintain supply than extending networks or building new power stations. In a true LCP approach, energy conservation and energy efficiency improvement are seen as an energy resource, equivalent to fossil fuels and renewable energy.

The US Department of Energy began a Least Cost Utility Planning program in 1986 (Mills 2001). It was later renamed the Integrated Resource Planning (IRP) program to emphasise the need for integration of demand-side and supply-side options (Mills 2001). Integrated resource planning does not focus on cost alone; it can include social and environmental objectives as option selection criteria (Swisher, Jannuzzi & Redlinger 1997, p.17). Interest in LCP and IRP waned during the 1990s as most energy sectors were deregulated and energy markets displaced central energy sector planning (Mills 2001). However, these methods are still proposed in the context of energy sector planning and climate change response (e.g. Anderson 2002; Malik & Sumaoy 2003; Mills 2001; Swisher, Jannuzzi & Redlinger 1997; Tellus Institute 2000).

An IRP approach uses detailed end use analysis, supported by appliance and equipment stock models and demand projections, to estimate the cost, energy saving, and load reduction associated with different demand management options. Demand management and supply options can then be compared using a consistent metric, such as the levelised cost per unit of energy supplied or saved (e.g. $/MWh).[39] One of the more difficult aspects of IRP is dealing with numerous uncertainties associated with future demand, stock trends and demographic trends. I will consider this issue in more detail in Chapter 5.

It should already be apparent from the discussion above that integrated resource planning does not aim for the type of integration contemplated by integral theorists. Rather, it is primarily aiming for a more comprehensive economic assessment that considers all options. If environmental and social objectives are also used as option selection criteria, then IRP moves toward integration of multiple developmental lines in the systemic quadrant. This type of integration is certainly necessary, but is not sufficient for an integral climate change response.

4.13 Discussion and conclusions

In Section 3.1.1, I outlined the objectives of this literature review and the guiding research questions. The main objectives of the review were to assess how adequately the existing literature on energy and climate change considers and integrates the different quadrant perspectives, to identify any research gaps that need to be addressed and to identify existing perspectives in the literature that should be included in an integral response to climate change. In this final section of the literature review, I discuss what it has revealed about progress towards an integral response to climate change, with reference to each of these objectives.

In Section 4.13.1, I discuss the distribution of the energy and climate change literature across and within the quadrants. In Section 4.13.2, I summarise, and in some cases expand on, work considered in the literature review that achieves some degree of integration across quadrants; this work should be included in any integral response to climate change. In Section 4.13.3, I identify research gaps and draw out implications for the remainder of the thesis. Finally, in Section 4.13.4, I comment on the value of an integral literature review.

4.13.1 Coverage of the quadrants

It is clear, from Chapter 3, that there is a voluminous literature that adopts an objective perspective on energy policy and climate change response. I have barely touched on that literature here. In the objective literature, the energy sector is framed as a series of interrelated physical or conceptual systems, including electricity networks, markets, rational market participants and regulatory institutions. In the behavioural quadrant, I reviewed the empirical evidence for climate change,

[39] Similar metrics are developed for capacity added or avoided (e.g. $/MW).

observations and explanations of human behaviour (and its relationship to energy use) and theories of energy consumption from evolutionary biology and sociobiology. In the systemic quadrant, I reviewed work on technological, ecological, economic and institutional systems. This coverage is not exhaustive but it does, I believe, capture the main developmental lines that are relevant to energy and climate policy.

The literature that adopts a subjective perspective on energy policy and climate change response is not nearly so vast. Consequently, I believe my coverage of subjective material is more complete, although again not exhaustive. From a subjective perspective, the energy sector is framed as contested conceptual territory, occupied by competing cultural discourses and varying personal values and attitudes. In the psychological quadrant, I considered individual motivations for energy consumption, psychological models of climate change response, the phenomenological experiences of energy consumption and climate change and the issue of uncertainty. In the cultural quadrant, I considered cultural influences on consumption, the role of discourse in climate change response, the ethics of climate change response and the ways in which collective decisions about climate change response are made.

While there are some evident gaps in the literature within particular quadrants, which I will discuss in Section 4.13.3, there is no evidence that any of the quadrants are entirely neglected in the academic literature. I was able to identify relevant literature from each quadrant, covering multiple developmental lines. However, although all quadrants are represented in the literature, the volume of material is clearly weighted towards particular quadrants. Material associated with the objective quadrants is much more common than material associated with the subjective quadrants; it was far more difficult to condense the objective material into a single chapter than the subjective literature. This weighting towards the objective is reflected in the IPCC's TAR, which devotes very little space, proportionally, to subjective material (see Sections 4.2 and 4.7). This finding is consistent with Wilber's argument that the subjective quadrants are neglected in modern Western civilisation.

It is also evident that literature adopting a systemic perspective is more common than literature adopting a behavioural perspective. Similarly, literature adopting a cultural perspective is more common than literature adopting a psychological perspective. This weighting towards the collective quadrants is unsurprising; climate change is a complex global issue, involving all humans and other species, which demands a collective response. While observations of individual behaviour and interpretations of individual values can certainly help in formulating that response, disciplines that address collective systems and cultures are best placed to contribute to the climate change debate.

Methodologically, I identified literature that employed methods from seven of the eight methodological categories of integral methodological pluralism. I could not identify any specific applications of autopoiesis (in the behavioural quadrant) to energy policy or climate change response.[40] The other methods all made contributions to the literature review. Empiricism provides the evidence for climate change, observations of relevant trends and descriptions of behaviours that contribute to climate change. Systems theory underpins most of the literature discussed in Part B of Chapter 3. Social autopoietic thinking is evident in Unruh's (2000; 2002) work on technological and institutional lock-in and also in Lovelock's Gaia theory. Phenomenology provides the basis for Section 4.5 on the experience of energy consumption and climate change. The literature reviewed in Sections 4.3 and 4.4 applies structuralism, in various forms, to identify psychological structures that shape energy consumption and climate change response. Cultural studies is represented in the discussion of discourses in Section 4.9. Finally, much of Part B is informed by hermeneutic interpretation on the part of various authors.

Much of the literature concentrates on one or two developmental lines within a quadrant, consistent with disciplinary specialisation. This tendency is particularly strong in certain of the systemic quadrant disciplines, including climate science and economics, which often treat climate change as a discrete modelling problem, isolated from ecological, political and/or institutional considerations. Nevertheless, there are also many examples of literature that successfully integrates multiple developmental lines within a particular quadrant. The integrated assessment work discussed in Section 4.12.1 is particularly successful in this regard, mainly within the systemic quadrant. The work on lock-in integrates technological, economic and institutional lines. In the cultural quadrant, grid-group cultural theory successfully integrates multiple lines relating to discourse, metaphor and group solidarity.

Work that integrates multiple quadrants is less common. Most theorists and practitioners concentrate on a particular quadrant. However, some work does span the quadrants; I will summarise examples of such work in the next section.

4.13.2 Integral work in the literature

Throughout the literature review, I have identified work that achieves some degree of integration across quadrants or establishes such integration as an objective. Here, I will briefly summarise this work, as it provides an excellent foundation for an integral response to climate change. The IPCC's TAR deserves mention here. Although the IPCC has been criticised for its failure to fully integrate development, equity and sustainability concerns into its assessment, much progress has been made since the release of the FAR. It is encouraging that the TAR includes material from all the quadrants, even though the space devoted to psychological and cultural perspectives is proportionally very small compared to the space devoted to objective perspectives. While the TAR fails to integrate equity and development concerns into all stages of its assessment, the IPCC has

[40] However, as noted in Chapter 2, autopoiesis is not my area of expertise and I may have failed to recognise relevant literature applying this method.

demonstrated that is responsive to criticism and capable of organisational learning and development (Siebenhüner 2002), so these concerns may be better addressed in future assessments.

In Sections 3.3.4 and 4.4.4, I reviewed work that explains energy consumption and climate change response (i.e. human behaviour) with reference to psychological, social or cultural factors (e.g. Blake 1999; Jaeger et al 1993; Laitner, DeCanio & Peters 2000; Moisander 2000; Shove 2003; Thompson & Rayner 1998a; van den Bergh, Ferrer-i-Carbonell & Munda 2000; Wilhite et al 2000). Much of this work approaches an all-quadrants perspective on energy-consuming behaviour, taking into account empirical evidence of actual behaviour, psychological values, cultural discourses and social context. Jaeger et al (1993, p.207) are representative when they conclude that: 'Climate relevant environmental action definitely seems to depend on cultural rules and social networks related to the issue of climate change'. That is, behaviour depends on structures in the systemic and cultural quadrants.

In Section 3.8.1, I noted that there is a strong focus in the international climate policy literature on the integration of disparate climate change and sustainable development discourses (e.g. Beg et al 2002; Cohen et al 1998; Michaelis 2003; Najam et al 2003; Robinson & Herbert 2001; Swart, Robinson & Cohen 2003). Crucially, the climate change discourse is portrayed as overly technical and instrumental in its reliance on modelling and its framing of climate change response in terms of emission reduction. The sustainable development discourse is seen to offer greater sensitivity to social and cultural context, including issues of equity, poverty, adaptation and participation. Cohen et al (1998, p.363) summarise the kind of integration that is sought: 'It seems clear that it would be desirable to broaden the [climate change] scenario analyses to include a much richer picture of the socioeconomic, political, historical and cultural dimensions of human behaviour and choices'. In other words, Cohen et al and the other authors cited above are calling for integration of concerns from each of the quadrants.

In Section 3.8.3, I discussed principles for institutional change. Connor and Dovers (2004), in their work on institutional change for sustainable development, employ a developmental perspective that integrates concerns from the social and cultural quadrants. They discuss the need for institutional accommodation of a sustainability discourse, recognising that cultural discourses must be expressed as social practices. In one of their principles of institutional change, they specifically call for normative change, or 'change in group-held values' (Connor & Dovers 2004, pp.208-212), which is essentially a call for cultural development. They make the point that institutional change is an iterative process comprising cycles of institutional change and value change. Either can act as the driver for a change in the other. Wilber (2003a, Part III, p.1) makes a similar point, arguing that social change typically comes about when a small group of people with a particular set of values establish institutions and practices that act as a pacer for more widespread value change. Connor and Dovers are evidently aware of this interplay between institutional (systemic quadrant) development and development of group values (cultural quadrant).

In another principle, Connor and Dovers (2004, pp.216-219) specifically call for integration of policy and practice. They call for a conceptual integration of ecology, economy and society, integration across scales of governance and reconciliation of different values and priorities. This call for integration clearly resonates with integral theory, particularly the issue of how to reconcile different values and priorities. I will consider this issue in more detail in Chapters 7 and 8.

Some of the work on consumption, discussed in Sections 4.3 and 4.8, approaches an integral perspective. Michaelis (2000a; 2000b; 2001; 2003), in particular, draws on all quadrants in explaining consumption. In his work on the drivers of consumption, Michaelis (2000a) identifies behavioural drivers (demographic change and habit), systemic drivers (economic and technological change, infrastructure, resources and social structures), psychological drivers (motivation, need and compulsion) and cultural drivers (identities, discourse and symbols). Further, in discussing successful leadership, Michaelis (2003, p.S143) describes many of the features of the integral value structure discussed in Section 2.3.5:

> A key feature of successful leaders is that they are not attached to a particular worldview or cultural frame. They can cope with diversity, having a facility for seeing the world from others' points of view. They recognise the value of different perspectives, and are able to manage the interaction between them. They are also willing to reflect on their own behaviour and to learn from others.

The ability to recognise, value and manage the interactions between different perspectives is central to any integral response to climate change.

Bulkeley (2000b) and Dryzek (1997; 2000), whose work I discussed in Section 4.9, both stress the importance of material forces and institutions (systemic quadrant) and discourses (cultural quadrant) in political interaction and policy formation. Bulkeley describes discourse coalitions in the Australian climate policy network that are comprised of storylines (cultural quadrant) and social practices (systemic quadrant). Dryzek (2000, p.18) discusses how social and political rules constitute 'institutional hardware', whereas discourses constitute 'institutional software'. Elsewhere, he stresses the importance of material interests and power, as well as discourses, in collective decision-making (Dryzek 2000, p.79). Both authors successfully integrate the objective and subjective.

Finally, in Section 4.11.3, I introduced a cooperative discourse model for public participation in decision-making that seeks to integrate analytic reasoning with deliberation and interpretation (Renn 1999; Renn et al 1993). The cooperative discourse model seeks to integrate objective knowledge generated by experts with the values and preferences of stakeholders and citizens. It seeks to include 'the objectified world of outer nature (nature and society); the social-cultural world of norms and values; and the subjective worlds of individuals' (Renn 1999, p.3049). That is, it attempts to integrate the systemic, cultural and psychological quadrants within a decision-making process.

The work summarised in this section spans the quadrants and should certainly be included, or at least considered, in any integral response to climate change. However, for the most part, the work considered here does not attempt to integrate theories of psychological and cultural development into its explanations. Indeed, a developmental perspective was clearly missing from the work reviewed in this chapter. In the next section, I will consider this and other research gaps that were evident from my literature review, and their implications for the remainder of the thesis.

4.13.3 Research gaps and their implications for the thesis

It is clear from the discussion in Section 4.13.1 and 4.13.2 that most of the elements of an integral response to climate change are already present in the literature. In the work of some authors, two or more of these elements are woven together to approach an integral response. However, complete integration of behavioural, systemic, psychological and cultural elements is rare. The primary task for an integral response to climate change is to convincingly integrate existing literature across the quadrants.

There are several tasks, however, that need to be undertaken in preparation for this project of integration. First, it is necessary to clarify the content of Australia's existing energy and greenhouse policy and the processes used to develop that policy. Current policy is the departure point for development towards an integral policy response and must therefore be clearly understood. In Chapter 5, I undertake a critical review of Australian energy and greenhouse policy to provide a clearer understanding of the starting point for further development.

Second, there is a need to fill evident gaps in the Australian energy and climate policy literature. I have identified several such gaps during the literature review. One relates to the treatment of uncertainty in Australian energy policy development processes. From the discussion in Section 4.6, it is clear that uncertainty is a pervasive issue for energy and climate policy and that predictive modelling tools, widely used in policy development, do not treat uncertainty adequately. In Chapter 5, I will analyse the treatment of uncertainty in two predictive modelling tools employed in the development of Australian energy policy: energy projections and vintage stock models.

Another gap in the literature relates to the relative costs of fossil fuel energy and renewable alternatives and, in particular, the role of public subsidies in creating a cost differential between these technologies. In Section 3.7.3, I discussed some of the reasons for the observed cost differential between fossil fuel energy and renewable energy technologies. It was apparent that the cost differential is as much a result of historical path-dependent processes in the energy sector and existing market and institutional structures as any inherent advantage of fossil fuels. I therefore concur with Mills (2000), who argues that the apparent economic barriers to renewable energy are really political and institutional barriers related to market and policy design. Subsidies for fossil fuel production and consumption are one such barrier. However, there has been a lack of information on the nature and magnitude of energy and transport subsidies in Australia. I address this research gap in Chapter 6 by estimating the magnitude of energy and transport subsidies in Australia, with the objective of providing an improved basis for economic assessment of alternative energy supply options.

Third, as noted above, a developmental perspective was clearly missing from the existing work in the psychological and cultural quadrants. Some of the literature reviewed, particularly in the cultural quadrant, was openly hostile to a developmental perspective. For the discourse theorists discussed in Section 4.9, discourses exist side by side as competing cultural visions of how to organise the world. While Dryzek (1997, p.5) is open to ideas of development and progress, Thompson and Rayner (1998a) and other grid-group cultural theorists explicitly distance their climate change discourses from evolutionary theories, thereby positioning themselves in opposition to integral theory.

Despite this, I believe that it may be possible to relate these discourses developmentally by correlating the waves and streams identified by developmental theorists with the characteristics of the discourses described by grid-group cultural theorists. In Chapter 7, I will explore this possibility in some detail. In that chapter, I seek a rapprochement between cultural theory and developmental theory that includes the valuable insights of the discourse approach to climate change within a broader integral framework. To the extent that this rapprochement is successful, it provides a pathway for inclusion of a developmental perspective in the psychological and cultural literature on energy and climate change.

Regardless of the success of this rapprochement, it is clear that there are numerous cultural narratives and discourses that interact in the realm of climate policy. Each discourse has a different worldview and a different perspective on energy use and climate change response. An integral response to climate change must find some way to include each of the discourses identified in the cultural quadrant in policy and decision-making processes. This will require institutional changes to policy development processes. I will consider policy processes that facilitate inclusion of multiple discourse perspectives in Chapter 8.

4.13.4 The value of an integral literature review

To conclude this chapter, and the literature review, I would like to briefly comment on the value of an integral literature review as a research tool. I have found that using integral theory to guide a literature review has advantages and disadvantages. One benefit is that it provides theoretical guidance and rigour that is sometimes lacking in literature reviews. The quadrants help to guide literature searches into areas that might otherwise be overlooked. More important, I believe, is the ability to judge the claims and conclusions of literature based on the quadrant location of the methods used. This is best illustrated using an example.

Unruh's (2000; 2002) work on carbon lock-in laudably integrates technological, economic and institutional lines within the systemic quadrant. However, as discussed in Section 3.8.3, Unruh

(2002) arrives at some quite pessimistic solutions about the potential to move away from carbon lock-in. In particular, he is pessimistic, given the complexity of climate change, about the potential for education to establish a social consensus for climate change response. Taking an integral perspective, I would argue that Unruh's (2002) conclusion gives too little consideration to the development of values and associated conceptions of climate change. The complexity of climate change *does* make education difficult; the response is not to abandon education but instead to give greater attention to the subjective developmental processes that education tries to facilitate. Further, if a social consensus on climate change response is needed, then attention to collective decision-making processes and discourse is required. Unruh, by focusing on the systemic quadrant, is unable to identify these possible solutions. From an integral perspective, they become clear.

On the negative side, an integral literature review is a very significant undertaking, particularly for an issue that has received as much attention as climate change. It is a difficult task for a researcher to master literature from all the quadrants and the result will inevitably lack depth or coverage in areas that other researchers will identify as important. Perhaps, having a basic understanding of the quadrants that allows one to delineate one's own research is sufficient. I will return to this point in Chapter 9.

Further, while integral theory provides a useful structure for a literature review, it provides little assistance with identification of the lines that are important for addressing a given problem. The need to reduce the complexity of the real world to something more manageable makes selection of lines to focus on a practical necessity. Integral theory does not, so far, say much about which lines are crucial to particular types of problems. I have concentrated on the developmental lines that emerged naturally from the literature but there is no guarantee that these are crucial to the understanding of climate change. I will also return to this point in Chapter 9.

5. A Critical Review of Australian Energy and Greenhouse Policy

> Like many others, I have often found it embarrassing to be an Australian at international climate change meetings. While most other countries manage to balance domestic economic interests with a concern for the future health of the global environment, the Australian Government is widely seen as pursuing narrow, short-term trade interests with little regard for the effects of climate change on other people or future generations.
>
> - Clive Hamilton, *Running from the Storm*

5.1 Introduction

In this chapter, I turn from the academic literature to Australian policy practice in order to provide a link between the literature and the practical task of climate change response. This link will become particularly important in Chapter 8, where I propose an integral policy response to climate change. Here, my intention is to clarify the nature and limitations of current policy practices as the starting point for a transition to an integral policy response. I am also inspired by Healy's (2003, p.694) call for examination of the 'critical role of practices, methods and their institutional manifestation' in structuring knowledge. The guiding research question is:

- How adequately do Australian energy and climate policy development practices consider and integrate the different quadrant perspectives?

My main methods in this chapter are literature review, participatory action research and some basic spreadsheet modelling. The methods employed for the literature review are as described in Section 3.1.2. My approach to participatory action research is described in Section 2.5.5. The modelling work is discussed in Sections 5.4 and 5.5.

My review starts, in Section 5.2, with a critical discussion of the evolution and content of Australian energy and greenhouse policy. Then, in Section 5.3, I summarise the institutional processes and tools employed in Australia to develop energy and greenhouse policy. This summary provides a starting point for more detailed analysis and review of some particular policy tools employed in Australia, including energy projections by ABARE (Section 5.4), vintage stock models (Section 5.5) and scenarios (Section 5.6). In Section 5.7, I conclude with an integral assessment of Australia's climate change response.

5.2 Australian energy and greenhouse policy: content and criticism

I have already outlined, in Section 3.8.2, the actors involved in the Australian energy and climate policy networks. However, I said little in that section about the content of Australian energy and greenhouse policy. As the introductory quotation from Clive Hamilton indicates, Australia's greenhouse policy has many critics. Thus, there is an extensive literature on which I can draw in this chapter (e.g. Bulkeley 2000b, 2001; Diesendorf 1998; Hamilton 2001; Hamilton & Vellen 1999; MacGill, Outhred & Nolles 2003; Pollard 2003; Saddler, Riedy & Passey 2004; Turton 2002). In this section, my focus is on the content of Australian energy and greenhouse policy and some of the existing criticisms. In Section 5.2.1, I trace the evolution of Australia's energy and greenhouse policy from the early 1990s through to the present. In Section 5.2.2, I consider Australia's unusual policy position on the Kyoto Protocol. Finally, in Section 5.2.3, I examine Australia's long-term policy response to climate change.

5.2.1 The evolution of Australian energy and greenhouse policy

Although energy use is the major source of Australia's GHG emissions, energy policy and greenhouse policy have often developed along separate paths, with different objectives. The primary objective of energy policy in Australia over the last decade has been the introduction of competitive energy markets to improve economic efficiency and lower energy prices. Environmental objectives have not been central to energy policy. This situation is partly explained by the differing storylines of the resource-based and greenhouse-action discourse coalitions in Australia, described by Bulkeley (2000b) and discussed in Section 4.9.3. The dominant resource-based coalition seeks to maximise the economic returns from exploitation of Australia's energy resources, whereas the greenhouse-action coalition seeks a precautionary climate change response.

Despite the conflicting objectives of these discourse coalitions, there has been progress towards integration of energy and greenhouse policy. Early progress was achieved through consensus pursuit of measures that have both economic and environmental benefits, known as 'no-regrets' measures (Bulkeley 2001). More recently, the Australian Government's energy policy statement (DPMC 2004) dealt explicitly with both energy and greenhouse policy. In the sections below, I will start by providing some background on the history of energy market reform and greenhouse policy processes before turning to the content, and criticisms, of Australia's current policy.

Energy market reform

Until 1994, each State and Territory government in Australia provided for its own energy needs through state-owned utilities responsible for central planning of energy generation and production, transmission, distribution and retail (Diesendorf 1996). Pressure for energy market reform grew through the late 1980s and early 1990s, linked to increasing levels of State government debt and oversupply of electricity generating capacity resulting from optimistic demand assumptions (ACG & MMA 1999). The Industry Commission (now the Productivity Commission) and the Independent Committee of Inquiry into a National Competition Policy for Australia (the Hilmer Inquiry) both published reviews in the early 1990s that identified significant potential benefits available through energy market reform (Hilmer 1993; Industry Commission 1991b).

In 1991, the Council of Australian Governments agreed to commence a process of energy market reform, including development of a competitive national electricity market in the eastern States and separation of monopoly elements from contestable elements in the energy sector (ACG & MMA 1999). The reforms were driven by the desire to create a more competitive market for energy and thereby to reduce electricity prices (Diesendorf 1996). This initial reform process resulted in the separation of state-owned, vertically integrated utilities into separate generation, transmission, distribution and retail businesses, corporatisation or privatisation of these businesses, establishment (in 1998) of the National Electricity Market and an arrangement to ensure third party access to monopoly natural gas pipelines. The reforms introduced competition between generators and established economic and access regulation of monopoly transmission and distribution businesses (COAG 2002). Full retail competition has also been introduced in most states, allowing customers to choose their electricity retailer.

While the primary objectives of energy market reform were increased competition, improved economic efficiency and lower energy prices, the Australian Government also expected the reforms to reduce GHG emissions from the energy sector (Australian Government 1997). In fact, due to increased electricity market participation by the lowest cost brown coal generators, energy market reform has resulted in an increase in GHG emissions compared to business as usual projections (COAG 2002). The reforms did not include any specific rules or measures to prioritise GHG emission reduction, so this result is hardly surprising.

The interim planning target and National Greenhouse Response Strategy

As pressure for energy market reform grew in the late 1980s, momentum was growing internationally and in Australia for action on climate change. In 1990, the Australian Government adopted an interim planning target to stabilise GHG emissions at 1988 levels by 2000 and to achieve a 20 per cent reduction by 2005, subject to the important caveat that any GHG abatement measures should not have a net adverse economic or trade impact (Industry Commission 1991a). The Australian Government considered options for achieving the target through two processes: the Australian ecologically sustainable development (ESD) process and an Industry Commission inquiry (Bulkeley 2001). These processes led to the establishment of a National Greenhouse Response Strategy in 1992 (National Greenhouse Steering Committee 1992).

The Australian ESD process, discussed in Section 1.2.1, was the first major consultative process to address Australian greenhouse policy. Established in 1989 by the Commonwealth Government, the

ESD process included a working group on greenhouse policy, with representation from government, industry and environmental organisations, operating as a deliberative institution (Bulkeley 2001, p.160). In late 1991, the working group reached a consensus that called for precautionary measures to respond to climate change, particularly 'no-regrets' measures that combine economic and environmental benefits, such as energy efficiency improvements (Bulkeley 2001). The working group interpreted no-regrets measures as potentially having a negative impact on some sectors of the economy, as long as the overall societal impact was economically neutral or beneficial (Bulkeley 2001, p.161).

The idea that environmental protection is consistent with economic growth is commonly associated with an 'ecologically modern' interpretation of sustainable development (Bulkeley 2001, p.157). The discourse of ecological modernisation does not normally reflect on the structure and norms of modern society, preferring instead to address ecological problems within existing institutional structures. Thus, Bulkeley (2001, p.159) notes that the consensus achieved through the ESD process did not represent a challenge to 'the relation between energy and the economy [or] the basis of industrial modernity'. Nevertheless, it was a remarkable achievement for a process involving groups with a history of antagonism, drawn from competing discourse coalitions. This achievement demonstrates the potential of deliberative institutions.

The Industry Commission used top-down economic modelling to assess the costs and benefits of the interim planning target and found that achieving the target would reduce Australia's national product by 1.5 per cent (Industry Commission 1991a, p.4). The Industry Commission also noted that some sectors of the economy, including the coal industry, would fare worse than others (p.4). I have already discussed the limitations of economic analysis at some length, in Section 3.7.2. The Industry Commission drew attention to some of these limitations, particularly uncertainty about the future cost of climate change (Industry Commission 1991a). Bulkeley (2001) notes additional limitations, including the assumption that markets are perfectly competitive, that market participants behave rationally and that a carbon tax was the appropriate mechanism for achieving GHG reduction rather than a package of policy measures.

Despite the limitations of economic analysis of this type, the subsequent National Greenhouse Response Strategy (NGRS) was predominantly influenced by the Industry Commission findings, rather than the ESD process consensus (Bulkeley 2001). Instead of a societal no-regrets strategy, the NGRS sought to minimise the economic burden on any sector or industry of any particular measure (Bulkeley 2001). Implementation of the NGRS proved difficult. While the NGRS included many worthy measures, they were systematically ignored in practice (Hamilton 2001, pp.34-35). In a scathing assessment, Wilkenfeld, Hamilton and Saddler (1995, p.5) found that: 'After two years of its operation, there is no evidence that even one tonne of carbon emissions has been saved as a result of the NGRS'.

A voluntary *Greenhouse Challenge* program, aimed at industry, followed the NGRS in 1995. This program encouraged businesses to implement voluntary, cost-effective GHG reduction measures in return for program membership and publicity. For Bulkeley (2001), this program further diluted the consensus achieved by the ESD process by limiting measures to those that were cost-effective at the level of individual firms, rather than the national or sectoral level. Hamilton (2001, p.48) is even more critical, arguing that the *Greenhouse Challenge* program 'looks like a publicly-funded [public relations] exercise for Australia's biggest polluting firms', and that voluntary measures in general have made little contribution to GHG emission reduction.

The Kyoto Protocol negotiations

Internationally, the failure of voluntary measures was reflected in the move towards a legally binding agreement to reduce GHG emissions – what would become the Kyoto Protocol. In the period leading up to the KP negotiations, Australia conducted a diplomatic campaign against uniform emission reduction targets, seeking special concessions for Australia if such targets were adopted: 'Essentially, the Government argued that due to Australia's reliance on fossil fuels, uniform emission reduction requirements would impose an unfair economic burden on Australia (Hamilton 2001, p.54). Instead, the Australian Government sought differentiated targets. It argued that Australia was a special case due its energy-intensive economy, its growing population and its position as an energy exporter, and therefore deserved a more lenient GHG reduction target than other developed countries (Hamilton 2001).

Australia's position was backed by economic modelling results, developed by ABARE, that showed large negative impacts on Australia's GDP, employment, wages and savings if emission reduction targets were implemented (Hamilton 2001, p.61). The accuracy and impartiality of this modelling work has been widely criticised (e.g. Bulkeley 2001; Diesendorf 1998; Hamilton 2001). It suffered from the general modelling limitations discussed in Section 3.7.2, as well as some specific limitations (e.g. exclusion of cheap non-energy GHG reduction measures and an assumption that long-term emission reduction targets would continue to exclude developing countries) (Hamilton 2001, pp.61-62). Although widely discredited, the ABARE modelling results strongly influenced Australia's commitment to differentiated targets.

Before and during the KP negotiations at COP-3, Australia's position attracted international derision and condemnation (Bulkeley 2001; Hamilton 2001). Nevertheless, Australia was eventually awarded a lenient KP target of limiting annual average emissions to no more than 108 per cent of 1990 emissions during the first commitment period. The chair of COP-3, Raoul Estrada, stated explicitly that the concession to Australia's demands was made 'only in the interests of obtaining unanimous agreement' (Hamilton 2001, p.89). Hamilton notes that the concession did not constitute acceptance of Australia's doctrine of differentiation, which was seen to contravene the internationally accepted principle of ‘polluter pays’. Rather, ‘political bargaining based on the threat to withdraw was the means by which Australia achieved its lenient target’ (Hamilton 2001, p.97).

The leniency of Australia’s target was increased by the late insertion into the KP, at Australia’s insistence, of Article 3.7 (often called the ‘Australia clause’) (Hamilton 2001, p.88). Article 3.7 allows Annex B parties to include emissions from land use change and foresty in their GHG inventory. Australia was the only Annex B party with substantial GHG emissions from these sources in 1990, and consequently is the only party in a position to exploit this clause (Hamilton & Vellen 1999, p.151). In 1990, Australia’s emissions from land use, land use change and forestry were 120.4 Mt CO_2-e; in 2002 they had reportedly fallen by 76 per cent to 29.2 Mt CO_2-e (AGO 2004d). It is important to note that the estimate of 2002 emissions is very uncertain and is likely to increase when additional remote sensing data becomes available. Nevertheless, these emissions have fallen sharply due to a substantial decrease in forest conversion (i.e. land clearing) emissions (AGO 2004c).

The large one-off reduction in land clearing emissions since 1990 has provided Australia with room under its target for substantial growth in energy-related emissions. Consequently, Australia has had little incentive to date to address growth in energy-related GHG emissions. These emissions grew by 34 per cent over 1990 to 2002 (AGO 2004c). Without GHG abatement measures, stationary energy emissions are projected to increase by 56 per cent, compared to 1990 levels, by 2010, and 91 per cent by 2020; with existing measures, increases of 41 per cent and 64 per cent are projected (Australian Government 2003b).

The National Greenhouse Strategy

Coinciding with the diplomatic negotiations described above, a review of the NGRS was conducted by a National Greenhouse Advisory Panel, with a similar multi-interest deliberative format to the earlier ESD working group (Bulkeley 2001). The resulting National Greenhouse Strategy (NGS), released in 1998 (Commonwealth Government 1998), reaffirmed the importance of no-regrets measures and attempted to broaden the spatial and temporal scales on which net costs are measured to the wider community and to longer timescales (Bulkeley 2001). In fact, the NGS included some measures that go beyond no-regrets, including the Mandatory Renewable Energy Target (MRET).

The NGS is current, and many of its measures are ongoing. In the stationary energy sector, these measures include electricity generator efficiency standards, the *Greenhouse Challenge*, the MRET, minimum energy performance standards for appliances and equipment and energy efficiency standards for buildings. The combined emission reduction expected from Australian Government measures specifically included in the NGS, compared to 2010 business as usual emissions from the stationary energy sector, is 21.6 Mt CO_2-e or about 7 per cent (Australian Government 2003b). This is substantially less than the projected growth in stationary energy emissions over the same period.

State governments have made some significant contributions to greenhouse policy through the NGS. The NSW Government has introduced a Greenhouse Gas Abatement Scheme that imposes mandatory GHG targets on electricity retailers through licence conditions. This program is expected to result in net GHG reduction of 5.4 Mt CO_2-e in 2010 (Australian Government 2003b). Further, the Queensland Government has adopted a Cleaner Energy Strategy with targets for use of natural gas in electricity generation. This program is expected to result in a net GHG reduction of 0.9 Mt CO_2-e in 2010 (Australian Government 2003b).

The Ministerial Council on Energy

As noted in Section 3.8.2, the Ministerial Council on Energy was formed in 2001 with the policy objective of delivering reliable energy services, a competitive market and sustainable development outcomes, while meeting social responsibility expectations (MCE 2001). The MCE has embarked on a second round of energy market reforms, aimed at streamlining market regulation and improving national coordination. To guide these reforms, the MCE initiated an independent energy market review during 2002 (MCE 2001). In its final report, the review panel recommended the implementation of an economy-wide GHG emissions trading system to address climate change concerns (COAG 2002).

This recommendation was not taken up in the Australian Government's subsequent energy policy statement, released on 15 June 2004 (DPMC 2004). According to the Federal Minister for the Environment and Heritage and the Federal Minister for Foreign Affairs and Trade, 'the Australian Government sees no need to impose significant, economy-wide costs, such as emissions trading, in advance of a globally effective response' to climate change (Kemp & Downer 2004). The rationale for emissions trading in greenhouse policy circles is that is allows the market to identify the most cost-effective opportunities for GHG abatement so that, far from imposing economic costs, it allows environmental objectives to be met as cheaply as possible. The rejection of emissions trading sits awkwardly with the Australian Government's ongoing commitment to meet its KP target and to avoid harm to Australia's economy.

In terms of likely reductions in GHG emissions, the most significant program currently being undertaken by the MCE is the development and implementation of a National Framework for Energy Efficiency (NFEE). The NFEE incorporates and builds on the earlier National Appliance and Equipment Energy Efficiency Program (NAEEEP), which includes minimum energy performance standards for appliances and equipment, compulsory energy labelling for some appliances, a standby power strategy and various voluntary programs. A discussion paper on the NFEE (E2WG 2003), a consultation process (E2WG 2004), and economic modelling work (e.g. Allen Consulting 2003; EMET 2004a, 2004b; Energetics 2004) all indicated that substantial economic benefits were available from stronger pursuit of energy efficiency measures. Consequently, in August 2004 the MCE agreed to the implementation, within three years, of the first stage of the NFEE, which includes nine policy packages to be implemented nationally for energy efficiency improvement (MCE 2004c). It also initiated a Productivity Commission inquiry into the economic and environmental potential offered by energy efficiency.

Of all the possible climate change response measures, energy efficiency measures are the most consistent with the doctrine of no-regrets that has historically dominated Australian greenhouse policy. The national coordination of energy efficiency measures through the MCE and the NFEE offers the potential to realise some of the environmental and economic benefits recognised more than a decade ago by the ESD working group. However, capture of these benefits will depend on the effectiveness of implementation of the new NFEE policy packages and the results of the Productivity Commission inquiry.

Securing Australia's Energy Future: the energy White Paper

In June 2004, the Australian Government released a new energy and greenhouse policy statement, officially titled *Securing Australia's Energy Future* (DPMC 2004), but commonly referred to as the energy White Paper. An Energy Taskforce within the Department of Prime Minister and Cabinet prepared the White Paper, guided by an Energy Committee within Cabinet, chaired by the Prime Minister. The close involvement of Cabinet and the Prime Minister in the development of the energy policy is indicative of its perceived importance.

Unfortunately, the White Paper contains few new policy commitments aimed at GHG emission reduction. This is one of the reasons why Lovegrove (2004) labels the White Paper a 'non policy' (the others are the failure to consider energy in terms of services rather than supply and the lack of a long-term plan to move Australia away from economic dependence on fossil fuel exports). According to Lovegrove (2004), the White Paper:

> …contains a lot of interesting background statistics, a collection of motherhood statements, and four policy contributions: reaffirmation of the position that the government will not ratify the Kyoto Protocol; a decision not to extend the Mandatory Renewable Energy Target; removal of excise on diesel fuel; some new and rearranged spending programs.

I will consider the basis for the Australian Government's decision not to ratify the Kyoto Protocol in Section 5.2.2 and will discuss the greenhouse impact of fuel excise removal in Chapter 6. The decision on the Mandatory Renewable Energy Target and the new spending programs deserve brief discussion for what they reveal about Australia's energy policy direction.

The Mandatory Renewable Energy Target

I introduced the Mandatory Renewable Energy Target in Section 3.8.2. The MRET is the most significant renewable energy industry development program adopted in Australia to date, although as a consequence of growth in electricity demand and implementation issues, its aim of a 9,500 GWh increase in renewable energy generation by 2010 amounts to only a 0.2 per cent increase in the renewable share of electricity generation (MRET Review Panel 2003, p.120). Nevertheless, the MRET has supported strong growth in hydroelectricity, solar hot water and wind power since its inception in 2000 (MRET Review Panel 2003). A review of the MRET in 2003 found that it had exceeded its interim targets in each year of operation (MRET Review Panel 2003). The review panel recommended continuing the program through to 2020 with an increased target of 20,000 GWh per year by that year. Most of the submissions to the review panel called for an increase in the target to 5 or 10 per cent additional generation by 2010, citing industry development objectives and comparing Australia's target unfavourably to international targets (MRET Review Panel 2003, pp.121-123).

As noted above, the Australian Government elected to make no change to the target. This policy decision is disappointing from the perspective of climate change response. Without an increase in the target and an extension beyond 2010, investment in the renewable energy industry is expected to fall rapidly after 2007 (MRET Review Panel 2003, p.xvii). As businesses in the sustainable energy sector indicate that the existing target is not sufficient to achieve industry development objectives (MRET Review Panel 2003, p.122), the long-term value of the policy and the commitment of the Australian Government to renewable energy must be questioned.

The decision not to increase the MRET is particularly interesting for what it reveals about the inner workings of Federal Cabinet. Media reports (e.g. ABC 2004a) and statements by the Federal Environment Minister (ABC 2004b) strongly suggest that the Minister argued in Cabinet for an increase to the MRET but was defeated by other Ministers concerned about the continued subsidisation of the renewable energy industry and the economic impacts of the measure. This outcome provides support for Bulkeley's (2000b) analysis of the discourse coalitions that exist in the Australian climate policy network and their relative power. Dryzek (2000, p.79) points out that: 'Discourses and their contests do not stop at the edge of the public sphere; they can also permeate the understandings and assumptions of state actors'. Thus, Bulkeley identified the Federal Department of Environment and Heritage with the greenhouse action discourse coalition and other relevant Federal Government departments (responsible for foreign affairs, trade and industry) with the dominant resource-based discourse coalition. The success of the resource-based coalition in this case, despite the many submissions from the greenhouse action coalition and the Ministerial support for their position, is indicative of the disparity in power between the two coalitions.

New spending programs

The energy White Paper does include some new spending programs that will potentially impact on GHG emissions. The primary program, in terms of funding, is a Low Emissions Technology Demonstration Fund (LETDF) worth $500 million, commencing in 2006-07 (DPMC 2004, p.182). The LETDF supports 'industry-led projects for large-scale demonstration of low emissions technologies that could reduce the cost of technologies with significant long-term abatement potential' (DPMC 2004, p.182).

Significantly, the LETDF is equally available to the renewable energy industry and the fossil fuel industry. However, the intent is that industry will provide two-thirds of the funding for any particular project and the Government will provide one-third (DPMC 2004, p.144). This condition clearly favours the established fossil fuel sector, which has greater access to capital than the emerging renewable energy industry (Lovegrove 2004). The sustainable energy industry expects the bulk of the funding to go to the coal industry to support CO_2 capture and storage projects (BCSE 2004). The Prime Minister's Science and Engineering Innovation Council (PMSEIC 2002) and Australia's Chief Scientist (Batterham 2002) have previously expressed strong support for CO_2 capture and storage, indicating a preference for these types of projects amongst senior government advisors.

It is hardly surprising that the White Paper favours established industry sectors, given the extent of their involvement in the development of the policy. The Australian Broadcasting Corporation (ABC) obtained minutes of a confidential meeting of the Lower Emissions Technology Advisory Group (LETAG), (a group comprised of large companies in the energy and resource sector[41]), with the Prime Minister and Industry Minister in the lead up to the release of the White Paper (ABC 2004c). The minutes, taken by Sam Walsh from Rio Tinto (a multinational minerals and metals company), reveal that the Low Emissions Technology Demonstration Fund was specifically developed to accelerate investment in new technologies by established industries, including the LETAG members (Walsh 2004). The renewable energy industry was unaware of the existence of LETAG (ABC 2004c) and the minutes quote the Industry Minister as stating that 'if the Renewables Industry found out [about the meeting] there would be a huge outcry' (Walsh 2004, p.9).

The White Paper does include some funding programs specifically targeting energy efficiency and renewable energy, including $100 million (over seven years) to specifically support 'strategically important renewable energy initiatives' and $75 million for a Solar Cities trial that will examine the benefits of 'concerted use of solar and energy efficient technologies combined with interval metering' (DPMC 2004, p.182). However, as Lovegrove (2004) points out, continual changes to renewable energy support programs have created 'artificial boom/bust cycles in the renewable energy industry' that make the industry an unattractive prospect for investors. If renewable energy industry development is an objective, then the Australian Government must provide potential investors in the industry with greater certainty. Legislating a long-term renewable energy or GHG reduction target, sufficient to sustain long-term industry growth, is a promising approach adopted

[41] Members include Rio Tinto, Alcoa, Edison Mission Energy, Energex, Origin Energy, BHP Billiton, Orica and Boral.

internationally (e.g. UK DTI 2003). Ratification of the KP would also send an appropriate signal to investors. I will consider Australia's position on the KP below.

5.2.2 Australia's position on the Kyoto Protocol

As a consequence of the windfall reduction in land-clearing emissions discussed in Section 5.2.1, the most recent (2003) projections indicate that Australia's average emissions during the first KP commitment period (2008 to 2012) will be 110 per cent of 1990 emissions, slightly exceeding the target of 108 per cent (Australian Government 2003b). With the introduction of some additional measures, including the new measures in the White Paper, the claim that Australia is on track to meet its KP target seems reasonable (DPMC 2004, p.131). Yet, despite the leniency of Australia's target and the likelihood that the target will be met, the Australian Government has refused to ratify the KP. It remains publicly committed to meeting its KP target but argues that 'ratification of the Kyoto Protocol is not in the national interest' (DPMC 2004, p.24). This seemingly contradictory position warrants further consideration. The Australian Government has advanced several reasons for its contention that ratification of the KP is not in Australia's national interest. In a recent public lecture, Hamilton (2004) listed and debunked ten such reasons, building on earlier work (Hamilton 2001). Here, I will consider three of the most common arguments used to oppose ratification.

The first argument is that ratification will negatively impact Australia's economy, reducing projected growth in GDP and resulting in job losses (e.g. AAP 2002). Economic modelling results (e.g. ABARE 2002; Allen Consulting 2000; Jakeman et al 2002; McKibbin 2002) are typically cited to support this argument. I have already discussed the limitations of economic modelling of climate change at some length, in Section 3.7.2. These limitations cast doubt over arguments, based on economic modelling results, that ratification will harm Australia's economy. Economic modelling that predicts job losses is particularly problematic, as the 'structure of the models is too inflexible to allow for the rapid growth in [labour-intensive] renewable energy and energy efficiency industries' (Hamilton 2004, p.13).

Even if the economic modelling results are accepted at face value, the arguments remain unconvincing. The most recent economic modelling results commissioned by the Australian Government indicate that meeting the KP target without ratifying is worse for Australia's 2010 GDP than ratification (ABARE 2002; McKibbin 2002). Further, the modelling predicted that ratification would cause a net decline in real gross national product (GNP) in 2020 of no more than 0.21 per cent (ABARE 2002; McKibbin 2002). Considering that the modellers set economic growth at around 3.7 per cent per year, the predicted decline in GNP is insignificant compared to total projected growth in GNP of more than 100 per cent over the same period. As Hamilton (2004) points out, it constitutes a delay of some eight weeks in the doubling of Australia's wealth. According to any of the principles discussed in Section 4.10.1, it is ethically indefensible to use such a small delay in economic growth in a developed country to argue against ratification when many in the developing world live below the poverty line.

The second argument used against ratification of the KP is that it:

> …does not provide the basis for an effective long-term response as it does not include all of the largest emitters in the world, nor does it include a pathway for addressing developing countries, whose emissions will soon overtake those of industrialised countries (DPMC 2004, p.24).

The Australian Government's desire for developing country involvement is not based on genuine concern about the environmental effectiveness of the KP but on fear that developing countries will attract investment away from Australia. Australian Prime Minister John Howard bluntly stated this motivation:

> If we sign Kyoto under present conditions we would run the risk of losing investment that would otherwise be in Australia to countries like China and Russia. They don't have the same obligations because they are regarded as developing countries (Reuters News Service 2002).

Apart from the fact that this argument violates the international agreement in the FCCC and KP for developed countries to take leadership, it is simply unethical, for the reasons discussed in Section 4.10.1. To ask developing countries, with per capita emissions far lower than Australia, to participate in emission reduction when Australia refuses is grossly unjust.

The third argument, used during the KP negotiations and recently restated in Australia's *Third National Communication on Climate Change*, is that Australia is uniquely 'vulnerable to the potential economic impacts of international and domestic actions to reduce greenhouse gas emissions' (Commonwealth of Australia 2002, p.13). According to this argument, Australia's fossil fuel dependence and position as an energy exporter make cuts in GHG emissions relatively expensive. In fact, as Hamilton (2004) points out, GHG emissions from fossil fuel exports are counted in the country where the fuel is burnt, not in Australia. Further, Australia's energy efficiency is poor by international standards (Schipper et al 2000), which means that it is actually easier for Australia to reduce GHG emissions than most countries.

None of the three arguments outlined above is at all convincing. Nor are the additional arguments reviewed by Hamilton (2004). In addition, each argument relies on an assumption that defending business interests and promoting economic growth, rather than responding effectively to climate change, best serves Australia's national interest. Jacob (2003, p.105), in a review of the climate change negotiations at COP-8, concludes that 'the US, Australia and the developing nations…have implicitly declared protection of the opportunity for economic growth to be their highest priority'. This is the real reason for Australia's refusal to ratify the KP – fear of the impact on economic growth. Either the Australian Government is giving primacy to economic growth over environmental objectives, as Jacob concludes, or it believes that wealth provides the best basis for environmental protection. I would argue that the second interpretation is inconsistent with the parallel argument for developing country participation, as Australia is essentially arguing that the low levels of wealth in developing countries are adequate for environmental protection. Only the first interpretation is logically consistent with the Australian Government's argument.

5.2.3 Australia's long-term climate change response policy

According to the Australian Government's recent energy policy statement: 'Australia recognises the necessity of lowering global greenhouse emissions and that achieving this will require substantive action over the long term' (DPMC 2004, p.137). Further, the previous Minister for Environment and Heritage stated in Parliament that: 'By the end of the 21st century, if we are effectively going to address the issue of global warming, we will need to see a global reduction in greenhouse gas emissions of between 50 and 60 per cent' (Commonwealth Government 2002a, p.5212).

From my review of policy statements, government reports, media releases and the leaked LETAG meeting minutes (e.g. Batterham 2002; DITR 2004; DPMC 2004; Kemp 2004; Kemp & Downer 2002; PMSEIC 2002; Walsh 2004), the Australian Government's primary strategy for reducing energy-related GHG emissions in the long-term appears to be strong financial subsidies for established industries to develop low emission technologies, including capture and storage of CO_2 emissions from natural gas processing and fossil fuel combustion in power stations (see Section 3.5.2 for a discussion of these technologies). Ministers Kemp and Downer (2002) provide a policy summary:

> The Government will facilitate Australia's energy-intensive and trade-exposed sectors to respond to the challenges posed by greenhouse. For example, we will continue to encourage the development of promising low emissions technologies such as coal gasification, geological sequestration, coal gas to liquids and the hydrogen economy, based on the work of centres such as the [Cooperative Research Centre] CRC for Coal in Sustainable Development, the CRC for Clean Power from Lignite and GeoScience Australia.

Since this statement, the Australian Government has funded an additional CRC focused entirely on CO_2 capture and storage (the CRC for Greenhouse Gas Technologies, or CO_2CRC) and disbanded the Australian CRC for Renewable Energy, the only CRC focusing on renewable energy. Further, it has implemented the LETDF, which, as discussed in Section 5.2.1, will primarily fund low-emission fossil fuel technologies. It is also working, through COAG, to develop a regulatory framework for future carbon dioxide capture and storage projects (DITR 2004).

The policy focus on technology subsidies, as opposed to emissions trading, sits awkwardly with the Australian Government's broader market philosophy and commitment to competitive, least-cost solutions. Rather than allowing markets to identify least-cost solutions to achieve established environmental objectives, Australian Government policy comprises ad-hoc subsidisation of technological solutions in the energy sector. The MRET is just as much an example of this policy as the LETDF; neither contain any long-term environmental objectives or focus on least-cost abatement.

The Australian Government often justifies a strong focus on CCS with statements such as: 'given Australia's high level of fossil fuel resources, we can be expected to remain substantially reliant on fossil fuels for energy needs for the foreseeable future' (DITR 2004, p.3). This statement is logically inconsistent – the possession of a high level of resources does not equate to reliance. Australia also possesses a high level of renewable energy resources, particularly solar and wind resources; the Government never makes the argument that we should therefore be reliant on these resources.

A better argument is that the Government is trying to position Australia as a provider of low-emission fossil fuel technologies to the world, taking advantage of Australia's abundant fossil fuel resources and responding to projections by the IEA (2002b) indicating that fossil fuels will provide 90 per cent of growth in global energy demand through to 2030 (DITR 2004, p.3). However, there is a serious problem with this argument. The IEA projections are based on a reference scenario that only includes policy commitments up to 2002. In a future in which climate change response becomes a high international priority, these projections will no longer hold. Indeed, the IEA (2002b) presents an alternative policy scenario in which there is significant switching to less carbon-intensive fuels. In such a world, the market for fossil fuels will steadily decline.

In addition, critics of CCS technologies point out that they introduce higher levels of technological, environmental and financial risk than proven low-carbon technologies like natural gas and wind power (Baer 2003; Saddler, Riedy & Passey 2004). It is far from clear whether CCS will be technically and economically viable and, crucially, whether the public will be willing to accept a technology perceived to be burying pollutants under ground (Shenton & Beer 2003). Concentrating too strongly on CCS, at the expense of other options, is risky as it diminishes flexibility to respond to unexpected developments, such as technological failure or climate surprises. Importantly, major coal-fired power stations in NSW and South Australia are distant from suitable CO_2 storage sites, meaning that 39 per cent of Australia's existing electricity generation emissions are not suitable for CCS (Bradshaw et al 2002). Further, emissions from transport and non-energy sources cannot be reduced using CCS.

Many of the actors involved in the Australian climate policy network, particularly environmental NGOs and renewable energy industry groups, argue that Australia's existing climate policy is insufficient to achieve long-term GHG emission reductions of the magnitude required to stabilise the climate. For example, Pollard (2003) reviews Australian Government greenhouse spending and concludes that most of it is ineffective or inefficient and poorly targeted to position Australia for the deeper cuts in GHG emissions that will be required in the future. Consequently, many actors have released alternative policy proposals. These proposals focus, for example, on ways to improve energy efficiency (e.g. BCSE 2003; Greene & Pears 2003), comprehensive policy packages for deep cuts in GHG emissions (e.g. Saddler, Diesendorf & Denniss 2004; Turton et al 2002) and electricity industry sustainability (Watt & Outhred 1999). In Chapter 8, I will propose an integral response to climate change that draws on some of these proposals and attempts to address the limitations of Australia's existing greenhouse policy.

5.3 Overview of policy development processes and tools

In this section, I provide an overview of processes and tools used to develop energy and greenhouse policy in Australia. I discussed three of the most prominent policy development tools used internationally in Chapter 3 – experience curves (in Section 3.5.4), climate models (in Section 3.6.2) and economic models (in Section 3.7.2). Here, I consider policy tools and processes applied in an Australian context. I use the overview to identify particular policy tools for further review in later sections of this chapter and to provide a foundation for the design of an integral climate change response in Chapter 8. While this is not an exhaustive overview, I do attempt to cover the main tools and processes used in Australian energy and greenhouse policy development, including economic analysis (Section 5.3.1), energy projections (Section 5.3.2), stock models (Section 5.3.3), scenario planning (Section 5.3.4), public inquiries (Section 5.3.5) and consultative processes (Section 5.3.6).

5.3.1 Economic analysis

As discussed in Section 5.2.1, economic objectives are at the heart of energy market reform; economic analysis by the Industry Commission (1991b) was crucial in initiating the reform process. Similarly, as discussed in Sections 5.2.1 and 5.2.2, economic modelling has been central to the development of Australia's past and present greenhouse policy. In Section 3.7.2, I discussed serious general limitations of economic analysis for climate policy applications. I have discussed additional specific limitations of Australian models in Sections 5.2.1 and 5.2.2. According to grid-group cultural theorists Ney and Thompson (1999, p.211):

> The uncertainties that are inherent to issues such as global climate change…have undermined the efficacy of conventional policy tools: tools (such as cost-benefit analysis, general equilibrium modelling, and quantitative risk assessment) that insist on the clear and undisputed separation of facts and values.

These tools leave no room for plural perspectives (Ney & Thompson 2000, p.77); only a rational economic perspective is embodied in the modelling results

Yet, despite the evident limitations, economic analysis remains the dominant tool used to develop and support Australian energy and greenhouse policy. For example, economic concerns and modelling results were central to the LETAG meeting on the content of the energy White Paper (Walsh 2004), discussed in Section 5.2.1.[42] Widespread academic criticism has failed to dislodge

[42] In the meeting minutes, the Prime Minister notes his 'concerns at the economic impact of [an expanded MRET] and concern that its implementation would have the effect of reducing economic progress in Australia' (Walsh 2004, p.1). Elsewhere, the Prime Minister cited economic modelling results on the impact of MRET on industry compared to the impact of the proposed LETDF (Walsh 2004, p.4).

economic analysis from its central role in policy decision-making. Slaughter (2004, p.xxiv) summarises the problem:

> …politics, economics, trade and finance are all urgently in need of reconceptualization and reconstruction. Currently they are operating largely out of taken-for-granted 'flatland' concerns and are very much 'part of the problem'. Each has been thoroughly worked over and critiqued for some years. But these powerful entities remain strongly resistant to any suggestion that their principles and practices should be revised in line with a different set of values, assumptions and presuppositions. Such options are simply not on offer.

Economic theory, economic growth and economic analysis have become ideological commitments and the value assumptions underlying these commitments are buried, forgotten or ignored (Davies 2004; Hamilton 2003; Slaughter 2004). The commitment to economic growth is a good example of what Dryzek (2000, p.83) calls a 'state imperative' – a perceived core function of the state that overrides other policy objectives. There are few better illustrations of the strength of the ideological commitment to economic growth in Australia than the reaction of NSW Treasurer Michael Egan to Clive Hamilton's book *Growth Fetish*, which challenges the assumption that economic growth and consumption deliver well-being. In response to an article sympathetic to *Growth Fetish* by Ross Gittins, the Economics Editor at *The Sydney Morning Herald*, Egan declared: 'Clive Hamilton's garbage is just silly, dangerous, left-wing crap' (Gittins 2003). In fact, Hamilton is only one of many authors arguing, usually based on strong empirical evidence, that economic growth does not deliver on its promises of well-being (e.g. Inglehart 2000; Kahneman 2003; Layard 2003 and see Section 4.3.1).

The discourse approaches discussed in Section 4.9 indicate that ideological commitment to economic growth is particular to certain discourses and not shared by others. Thus an exclusive, even strong, reliance on economic analysis for policy development risks excluding a range of perspectives that could have much to offer to the policy development process. I will examine discourse approaches in more detail in Chapter 7 and ways to include multiple discourses in policy development in Chapter 8.

5.3.2 Energy projections

Energy projections are closely linked to economic analysis. They provide data on future energy demand and prices to input into economic models and are often developed using economic models and techniques. Typically, energy projections use econometric or other quantitative analysis to project observed past behaviour into the future, with adjustments to 'take account of discontinuities such as the introduction of new technology, new lifestyle, or new policy instruments' (Uno 1999, p.1). Long-term projections in the energy and transportation sectors emerged, globally, to support regulatory authorities that were responsible for the development of energy resources and supply infrastructure (Anderson 2002; Robinson 2003). By providing a prediction of future energy demand, they allowed state-owned authorities to plan investments in energy infrastructure to meet that demand. In deregulated energy markets, policy makers continue to use energy projections to assess whether energy supply investment is sufficient to meet demand and to provide a baseline or business as usual scenario against which to assess proposed policy changes. In addition, market participants use projections to assess the financial risks and benefits of investing in the energy sector.

As noted in Section 3.3.1, ABARE publishes regular projections of long-term energy supply and demand for Australia (e.g. Akmal et al 2004; Dickson, Akmal & Thorpe 2003; Dickson et al 2001). They are the only Australian energy projections that provide comprehensive coverage of all fuels and economic sectors and are widely used to provide a baseline for policy development (e.g. DPMC 2004, pp.36-40).[43] The IEA publishes world energy projections (e.g. IEA 2002b), which are also used to support policy development in Australia. For example, as noted in Section 5.2.3, IEA projections are sometimes used to defend the Australian Government's prioritisation of low-emission fossil fuel technologies. I will focus on ABARE's projections here, while noting that the IEA projections suffer from all of the general limitations of energy projections discussed below and in Section 5.4.

Since 2001, ABARE has used a dynamic partial equilibrium model of the Australian energy sector, called *E4cast*, to develop its energy projections. As an economic model, *E4cast* is subject to the general modelling limitations discussed in Section 3.7.2 and embodies the ideological assumptions discussed in Section 5.3.1. In addition, as a projection model, *E4cast* is subject to the general criticisms of predictive-empirical futures work that I discussed in Section 1.5.1. My earlier critique drew attention to the inability of predictive models to adequately address uncertainty in complex systems and the influence of subjective assumptions on modelling results. Both of these critiques apply to energy projection models in general, and consequently to ABARE's projections (and the IEA projections). I will consider their specific application to ABARE's projections here.

The ABARE modellers do not ignore uncertainty. However, their sole method for exploring the impact of uncertainty on their projections is sensitivity analysis (Dickson, Akmal & Thorpe 2003; Dickson et al 2001). Sensitivity analysis is undertaken by making relatively small changes to modelling parameters, without changing the fundamental modelling relationships, and examining the quantitative impact on model output. Dickson, Akmal and Thorpe (2003) examine the sensitivity of their energy projections to different assumptions about gross state product (GSP), end use efficiency, primary fuel prices, and end use petrol prices. Another common approach is to present different projections based on low, medium and high economic growth assumptions (e.g. NEMMCO 2003).

While sensitivity analysis helps modellers to understand the quantitative impact of plausible changes in uncertain modelling assumptions, it usually results in only minor variations on the future

[43] Other organisations publish projections for specific fuels, such as electricity (NEMMCO 2003) or oil (Geoscience Australia 2004), but ABARE's projections are the most comprehensive.

presented in the original projection, as the underlying structure of the projection model remains unchanged. As Dreborg (1996, p.822) points out, sensitivity analysis cannot take into account trend breaks and other changes that alter the system dynamics and render the relationships between variables in the projection model invalid. Sensitivity analysis cannot account for the impact of innovation, system shocks or surprises (such as economic recessions or natural disasters), emergence and human intentionality on the type of future that eventuates (Dreborg 1996; Kay et al 1999; Soontornrangson et al 2003).

Consequently, even with sensitivity analysis, projections embody a narrow view of the future in which existing trends continue to unfold without significant disruption, innovation, or policy intervention according to an assumption of business as usual. In other words, they depict a future in which there is no fundamental change in the techno-institutional complex described in Section 3.5.4. In projections, existing technologies and institutions remain locked in. The assumptions employed in a projection model are necessary to support quantification of a particular future, however, their effect is to reduce the vast and uncertain territory of possible and desirable futures to one narrow pathway into the future. The future depicted in a projection is fragile and can easily collapse if a single assumption or modelling relationship proves false.

The limited treatment of uncertainty that is feasible in a projection model constrains the potential role of projections in policy development. Projections do not provide policy makers with an account of the breadth of possible futures, or an exploration of the possibility of trend breaks, but with a single quantified future consistent with particular assumptions. Importantly, energy projections do not *demonstrate* that energy demand will continue to grow in the future; rather, the result is a direct consequence of the assumptions, particularly the assumed rate of economic growth. This point is rarely emphasised in policy documents – usually, policy makers accept energy projections as a reliable baseline against which to assess the impact of proposed policy changes; certainly this is the case in the Final Report of the COAG Energy Market Review (COAG 2002, pp.60-62) and the recent energy White Paper (DPMC 2004, pp.36-40).

Given the important role of energy projections in policy development, and the limited exploration of uncertainty in most projections, it is worth examining the assumptions underpinning ABARE's energy projections in more detail. I provide a critical review of ABARE's energy projections in Section 5.4.

5.3.3 Stock models

An alternative to the use of partial equilibrium models or econometric techniques to develop projections of future energy demand is vintage stock modelling. Vintage stock modelling is a bottom-up modelling technique used to estimate the future energy consumption of a stock of energy-consuming appliances or equipment under various policy scenarios. Vintage stock models divide the total stock of an appliance into groups, or vintages, based on their year of sale. The modeller assumes that appliances of each vintage have energy consumption equal to the average energy consumption of all appliances of that vintage. The model tracks the fate of each vintage group over time using assumptions about the rate at which appliances retire from the stock. The modeller estimates the future energy consumption of the total stock of appliances in any given year by summing the energy consumed by each vintage group present in that year. Typically, stock models are developed as spreadsheet models.

In the realm of Australian energy and greenhouse policy, stock models have been used to assess the energy, economic and greenhouse impact of policy scenarios for residential buildings (Harrington et al 1999) and commercial buildings (EMET & Solarch 1999). Stock models are also used to assess the costs and benefits of proposed changes to appliance labelling and energy efficiency standards under the National Appliance and Equipment Energy Efficiency Program (e.g. GWA & EES 2001; Syneca Consulting 2003). Stock models are routinely used in other policy applications, such as development of future scenarios for power generation in Australia (Saddler, Riedy & Passey 2004).

As predictive models, stock models are open to many of the same criticisms raised above for energy projection models, although they avoid many of the limitations of economic models. In Section 5.5, I will examine treatment of uncertainty in a stock model developed by Energy Efficient Strategies (EES) for use in evaluating Australian energy efficiency policies, and compare it to stock models employed in the UK and US.

5.3.4 Scenario planning

Scenarios are alternative storylines about the future, qualitative and/or quantitative, that are used by policy makers and planners to improve understanding of possible future variation. Where empirical forecasting and projection methods depict a single future based on a single set of assumptions, scenarios depict coherent alternative futures based on varying assumptions. By expanding the range of possible futures considered during policy development beyond the single future captured by predictive models, scenarios offer a potential basis for more robust energy and greenhouse policies that are responsive to future uncertainty.

Scenarios have not played as significant a role in Australian energy and greenhouse policy development as is the case internationally. There has been one attempt to apply scenario planning as an input to policy development by the Ministerial Council on Energy (see SESSWG 2004). There have also been attempts by academics and NGOs to influence government policy through the release of scenarios depicting alternative energy futures (e.g. Saddler, Diesendorf & Denniss 2004; Saddler, Riedy & Passey 2004; Turton et al 2002). Strictly speaking, the outputs from sensitivity analysis and modelling of different policies using economic models or stock models are also scenarios. In this section, I am interested in broader exploratory and normative scenarios that attempt to describe alternative future societies. These two scenario types and their applications in Australian energy and greenhouse policy are outlined below.

Exploratory scenarios

Exploratory scenarios are used to provide a more complete map of possible futures. Some exploratory scenarios track subjective issues, although most are focused primarily on exterior, observable trends (Slaughter 2004, p.103). They provide coherent narratives about plausible alternative futures as a tool for robust policy development and decision-making. Given a more complete understanding of possible futures, policy makers can choose those options that will perform best across multiple futures. For example, Soontornrangson et al. (2003) describe the use of exploratory scenarios to establish quantitative upper and lower bounds on future energy demand. They show that these scenarios are valuable tools for choosing supply options that minimise the risk of future mismatches between energy supply and demand.

While Soontornrangson et al. (2003) use a purely quantitative approach, most exploratory scenarios include a mix of quantitative and qualitative elements. An example is the set of world energy scenarios through to 2050 developed by the IEA (2003b). Based on a review of existing scenarios, the IEA (2003b, p.60) identified the two major drivers influencing future energy consumption as the speed of technological change and the degree of public concern for the global environment. It developed four scenarios corresponding to different combinations of these two drivers (i.e. fast or slow pace of technological change and high or low environmental concern). Each scenario is expressed as a coherent narrative storyline about one way the future might unfold.

In Australia, the Strategic Energy Supply and Security Working Group (SESSWG), established by the MCE, commissioned a consortium of consultants led by the National Institute of Economic and Industry Research (NIEIR) and including the Southern Pacific Consulting Group, Resource Connections International Pty Ltd and the Houston Energy Group, to develop a set of exploratory energy supply and demand scenarios for Australia (NIEIR et al 2003; SESSWG 2004). I will call these scenarios the *Turbulent World* scenarios, after the title of the NIEIR et al. report. I will examine the detail of the *Turbulent World* scenarios in Section 5.6 and identify some important limitations resulting from the methods used to develop the scenarios.

From an integral perspective, exploratory scenarios have the potential to consider subjective values and their influence on the future, even if this potential is not often realised in practice. However, a map of possible futures says nothing about which futures are desirable, and how those futures might be achieved. This is the role of normative scenarios.

Normative scenarios

Normative scenarios do not predict likely futures or explore the range of possible futures. Instead, normative scenarios describe desirable futures and investigate the conditions under which such futures might be realised. As such, they provide a basis for policy intervention and action in the present to achieve defined objectives, such as GHG emission reduction targets. The IEA (2003b) points out that it is difficult to develop a normative scenario without having first developed exploratory scenarios. The exploratory scenarios provide a map of the future territory, whereas a normative scenario helps to navigate a desirable path through that territory.

Robinson (2003) is critical of futures work that fails to take into account the intentional or normative aspect of human behaviour. He points out that humans are constantly involved in creating preferred futures. Normative scenarios address this criticism by providing an explicit role for human intentionality, policy intervention and action. For example, the IEA (2003b) reports on a normative scenario designed to achieve climate change mitigation, energy security, diversification of energy supply and energy access. In the scenario, as a result of sustained policy intervention, world energy demand in 2050 is 15 per cent lower than in the reference scenario, zero GHG emission technologies supply 60 per cent of that demand, oil supplies no more than 40 per cent of world transport energy demand and 95 per cent of all people have access to electricity.

Several normative scenarios relating to energy and greenhouse policy have been developed in Australia, although none has been developed with direct government support. One example is the *Deep Cuts* scenario developed by Turton et al. (2002), the primary objective of which is to achieve a 60 per cent reduction in Australia's GHG emissions by 2050 relative to 1998-99 levels. The scenario identifies a plausible combination of currently viable technologies that could meet this objective, while ensuring that energy prices remain below current European levels. Another example is the *Clean Energy Futures* scenario, developed by Saddler, Diesendorf and Denniss (2004), which targets a 50 per cent reduction in GHG emissions from Australia's stationary energy sector by 2040.

Normative scenarios, because they are driven by a set of desirable objectives and values, provide a possible bridge between the objective and the subjective. People with different values will have different desires, and so will seek to create different normative futures. Policy development processes that draw out these different preferred futures are accessing the subjective quadrants. These different subjective futures can be modelled and quantified using objective methods. I will return to the role of normative approaches in an integral climate change response in Chapter 8.

5.3.5 Parliamentary and public inquiries

Parliamentary inquiries and independent reviews are common policy tools used in the development of Australian energy and greenhouse policy. Recent examples include an Independent Review of Energy Market Directions for the Council of Australian Governments (COAG 2002), a review of Australia's MRET (MRET Review Panel 2003), an inquiry into global warming by the Commonwealth Senate Environment, Communications, Information Technology and the Arts References Committee (ECITA Committee 2000), a Joint Commonwealth Senate and House of Representatives inquiry into the Kyoto Protocol (Joint Standing Committee on Treaties 2001) and an inquiry into the role of demand management in the State of NSW by IPART (IPART 2002b).

Typically, Commonwealth or State governments define the terms of reference for these inquiries and either assign the inquiry to a committee or independent authority, or appoint a review panel. The review panel calls for public submissions, sometimes in several rounds, and may hold public hearings and commission consultant's reports before finalising its report. Governments are not bound by inquiry findings but are usually expected to respond to the findings and to justify the decision to adopt or reject particular policy recommendations.

According to the typologies of participation discussed in Section 4.11.3, public inquiries and reviews fit into the **consult** category in the IAP2 spectrum, in that they seek public feedback and keep the public informed but do not allow direct involvement in decision-making. For Bishop and Davis (2002), public inquiries are a type of partnership, with a bias towards established interest groups. For Catt and Murphy (2003), public inquiries allow the public (or interest groups) to provide information but not to engage in significant contestation or synthesis. Thus, public inquiries are limited in the type of participation they provide; they are characterised by IAP2 as having a relatively low level of public impact and engagement.

The findings of public inquiries and reviews are not binding on governments, so there is no guarantee that even the limited participation enabled by an inquiry will impact on public policy. For example, the independent MRET review recommended an extension in the timeframe covered by MRET and an increased target in 2020 to stimulate development of the renewable energy industry (MRET Review Panel 2003). The Australian Government rejected this recommendation (Australian Government 2004b). In the leaked minutes of the LETAG meeting discussed in Section 5.2.1, the Prime Minister noted his concerns about the economic impact of an expanded MRET and sought the advice of the LETAG members on alternatives to the MRET review recommendations (Walsh 2004). The policy that was finally adopted, the LETDF, is entirely consistent with the discussions in the LETAG meeting. Clearly, in this case, business interests from established industry sectors were more influential on public policy than the recommendations of an independent public review. Nevertheless, the Prime Minister did note in the LETAG meeting that it was not credible to take no action in response to the MRET review report, so it is clear that governments are influenced by the findings of public inquiries.

In addition, the value of an inquiry for policy development is limited by its terms of reference. Often, these terms of reference are narrowly defined, limiting the potential for integration and synthesis of multiple policy objectives. For example, the Energy Market Review did not address the environmental and social impacts of energy markets in any detail. Its terms of reference only required it to consider 'the relative efficiency and cost effectiveness of options within the energy market to reduce greenhouse gas emissions' (COAG 2002, p.268).

5.3.6 Other participatory processes

Besides public inquiries and reviews, there are various other participatory processes used to provide input to Australian energy and greenhouse policy, with varying degrees of inclusiveness. The typical approach is to release an issues paper or discussion paper on a proposed policy change for review and seek public submissions, which are then considered in the final policy decision. So far, there have been no attempts in Australia, at least within core government policy processes, to use collaborative or empowering processes from the IAP2 spectrum to develop energy and greenhouse policy. Processes that inform or consult the public are most common. I will discuss some specific consultative processes below to illustrate the form that public participation currently takes in Australian energy and greenhouse policy.

Participation in energy market reform

The first round of energy market reform in Australia, discussed in Section 5.2.1, was undertaken with little community consultation and against significant public opposition (Hodge et al 2004). The Total Environment Centre (TEC), a peak Sydney-based environmental NGO, blames the past lack of consultation for the failure to adequately consider environmental and social objectives in the design of the NEM (TEC 2004). The TEC (2004) also criticises the consultation processes established by the MCE for the current round of energy market reform. I will consider some of the criticisms below after outlining a typical consultation process.

To illustrate a typical MCE consultation process, I will use the example of recent consultation on improving user participation in the energy market. A User Participation Working Group was formed within the MCE's Standing Committee of Officials.[44] This working group prepared and released a discussion paper (on the Internet) and called for written submissions (MCE 2004a). The availability of the discussion paper was publicised through an emailed Energy Market Reform

[44] The Standing Committee of Officials provides bureaucratic support for the MCE.

Bulletin[45], inviting interested parties to register for a consultation workshop and giving a month to prepare written submissions (MCE 2004d). Workshops were held in Sydney and Melbourne to present the details of the discussion paper to interested parties. Written submissions were received from one individual and 29 organisations; 19 submissions were from business interests, seven from consumer or social advocacy groups and one each from a State regulator, an environmental NGO and a university. The Standing Committee of Officials considered the submissions and released a final policy statement (MCE SCO 2004).

It is clear that the consultation process described above is designed to engage interest groups, rather than the general public. This focus is evident in the reliance on the Internet to publicise the discussion paper; many members of the public do not have access to the Internet. It is also reflected in the submissions received – only a single submission was received from an individual. Although the public is free to make submissions to the MCE and its processes, the complexity of energy policy and market reform issues is such that few citizens will have the time to develop the necessary expertise to effectively respond to consultation opportunities. To date, there has been little progress in developing robust and creative processes that could assist members of the Australian public to participate in electricity industry planning (Mills 2001).

The TEC (2004, p.8) summarises the problems with current energy market reform consultation:

> The standard of consultation in this process is far from adequate. Accessibility, outreach, information, resources and timelines all rank low. Information on consultation processes themselves are buried deep in government websites and require sophisticated technical and economic knowledge to engage. The process is hampered by restrictively short deadlines and under-resourced community and environment sectors.

This last point, on resources, is important. In the consultation example above, submissions from organisations representing public, environmental and social interests were significantly outnumbered by business submissions. In general, business has more resources to participate in consultation than environmental and social NGOs, which often struggle for funding and must divide their attention across numerous issues.

However, limited participation by environment and community groups is not only due to lack of resources. The TEC (2004, p.8) notes the 'exclusion of community and environment stakeholders [from] critical decision-making bodies and committees' and from regulation and management of the NEM. Business interests dominate these bodies, which consequently focus primarily on market objectives and mechanics, rather than broader environmental and social objectives. The MCE states in one of its communiqués that the objective of consultation is 'open communication with the market' (MCE 2003, p.2), as if nothing exists outside the market. It is clear that the business

[45] The MCE releases regular email Energy Market Reform Bulletins that provide information on the progress and implementation of energy market reform and inform those on the mailing list of upcoming consultation sessions. Anyone with an email address is free to register to receive these bulletins.

interests that operate in the market have a stronger voice in MCE consultation processes than environmental or community interests.

Participation in the White Paper

My earlier discussion of the role of LETAG in the development of the LETDF showed that business interests had a powerful influence on the energy and greenhouse policies included in the White Paper. This influence was also evident in the earlier consultation processes that eventually led to the release of the White Paper. In August 2002, as part of the consultation for its Climate Change Forward Strategy[46], the Australian Government held a Government-Business Climate Change Dialogue with invited business and industry associations (see Kemp & Macfarlane 2003). At this Dialogue, five working groups of business representatives were formed to examine long-term climate strategies for energy and resources, energy-intensive manufacturing, transport and infrastructure, agriculture and land management and cross-sectoral issues. At a second Dialogue, in April 2003, the working groups delivered their advice to the Australian Government on long-term climate strategy.

Although the business consultation commenced in August 2002, it was not until November 2002 that the Commonwealth Minister for Environment and Heritage first met with environmental NGOs, through the National Environmental Consultative Forum (NECF), to discuss the Climate Change Forward Strategy. It was not until late December 2002 that an agreement on a possible engagement process was reached (Danny Kennedy, 2003, pers.comm., 19 March 2003). On 13 March 2003, 21 Australian environmental NGOs from the NECF or the Climate Action Network Australia wrote to the Minister for Environment and Heritage to raise concerns about inequity in the participation process (i.e. exclusion of environment groups) and the Australian Government's ongoing failure to respond to their input by adopting policies that would substantially reduce GHG emissions (Danny Kennedy, 2003, pers.comm., 19 March 2003). In April 2003, these environmental NGOs withdrew from consultation on the Climate Change Forward Strategy, accusing the Australian Government of misleading the public by falsely claiming to consult with environmental groups and of bringing Australia to a 'crisis point' on climate change (Peatling 2003).

Upon the release of the White Paper, media releases from business and industry groups were almost unanimously positive in their assessments of the White Paper. Unsurprisingly, the White Paper was universally condemned by environmental organisations and the renewable energy industry. Again, it is clear that business and industry interest groups have more influence on policy than environmental and community interest groups.

[46] The Climate Change Forward Strategy was never released. The policy position developed through consultation on the Climate Change Forward Strategy became part of the broader energy and greenhouse policy in the White Paper.

Discursive participation

Dryzek (2000) points out that public participation in policy making does not have to occur through formal consultative processes; discourses in the public sphere can influence the state[47] through rhetoric and other forms of communication and transmission. It does not appear that the greenhouse action discourse is sufficiently strong, as yet, to have a major impact on policy making in this way. Although poll results regularly indicate that the majority of Australians believe that the Australian Government should ratify the Kyoto Protocol (e.g. Greenpeace 2002), this has not become a topic of passionate public debate and discourse. Consequently, there is little real discursive pressure on the Australian Government to change its policy of non-ratification.

In Chapter 8, I will consider ways to promote contestation of discourses and discursive participation in policy development, as well as ways to improve formal public participation and consultation processes.

5.4 ABARE's energy projections: assumptions and system dynamics

In Section 5.3.2, I outlined general limitations of energy projections and discussed the manifestation of these limitations in ABARE's energy projection model, *E$_4$cast*. In this section, I discuss additional specific limitations of *E$_4$cast* as a policy tool for the Australian energy sector. These limitations are a consequence of modelling assumptions adopted by the ABARE modellers. Specifically, I discuss assumptions relating to the treatment of demand management and renewable energy in *E$_4$cast* (Section 5.4.1), energy prices (Section 5.4.2) and the future availability of fossil fuels (Section 5.4.3).

In Section 5.4.4, I examine the historical reliability of ABARE's energy projections. Craig et al. (2002, p.83) argue that the primary role of energy projections is not to accurately predict the future but to 'provide insights to energy planners, influence the perceptions of the public and the energy policy community, capture current understanding of underlying physical and economic principles, [and] highlight key emerging social or economic trends'. It is in this spirit that I examine ABARE's past energy projections. I am interested less in their reliability and more in what they reveal about Australian energy system dynamics and the underlying physical and economic principles that drive the energy system.

In Section 5.4.5, I discuss the implications of my review of ABARE's projections for energy and greenhouse policy. The review is based primarily on the projections published by ABARE in 2001 (Dickson et al 2001) and 2003 (Dickson, Akmal & Thorpe 2003). My methods are systematic analysis of the model structure described in ABARE's publications and spreadsheet modelling to examine alternative assumptions and assess the accuracy of past projections.

[47] My usage of the term state in this chapter follows Dryzek's definition, cited in Section 4.11.4.

5.4.1 Treatment of demand management

In the partial equilibrium model (*E4cast*) used to develop ABARE's last two energy projections (Dickson, Akmal & Thorpe 2003; Dickson et al 2001), the impact of demand management is captured using an exogenously specified variable called the autonomous fuel efficiency improvement. The autonomous fuel efficiency improvement is the rate at which demand for fuel falls, relative to economic activity. It is a way of representing the tendency for energy users to find more efficient ways to generate the same economic activity over time.

Dickson, Akmal and Thorpe (2003) assume that demand for all fuels, relative to activity, will fall at 0.5 per cent per year in all sectors over the projection period (to 2019-20). This assumed rate of efficiency improvement is lower than the empirical trend of 0.64 per cent per year, also reported by the authors. It is not clear why the authors report this empirical trend, but do not adopt it. An assumption closer to the empirical trend would result in lower energy demand (PEC) over the period of the projections.

Dickson, Akmal and Thorpe perform a sensitivity analysis in which they increase the assumed rate of fuel efficiency improvement by 10 per cent, to 0.55 per cent per year. The effect is to reduce projected PEC by about 1 per cent over the projection period. The authors do not test the impact on PEC of adopting the empirical trend of 0.64 per cent per year, however, assuming a proportional impact, it is reasonable to expect that PEC would fall by about 3 per cent over the projection period. This is not insignificant, and demonstrates the sensitivity of projections to small changes in assumptions.

The modellers assume that: 'Consumers and producers of energy fuels…act competitively in each of the domestic, export and import markets' (Dickson et al 2001, p.10). That is, the chosen rate of efficiency improvement is based on an assumption that markets for energy services are perfectly competitive and there are no market barriers, failures or distortions preventing the uptake of cost-effective demand management measures. However, the literature reviewed in Section 3.7.2 and experiences with energy market reform in Australia both indicate that market failures and barriers are the norm in energy markets. Consequently, if governments act to proactively remove institutional and market barriers to demand management and implement low-cost policies to encourage energy efficiency improvement, the rate of efficiency improvement could be much higher than ABARE's assumption (Diesendorf 1998). This alternative policy future, which is actually more likely given the current policy focus on energy market reform, is excluded from the energy projections.

While the use of an autonomous fuel efficiency improvement rate is acceptable for a simple projection of existing trends it does not provide any indication of what type of energy efficiency improvements are *possible* or *desirable*. Consequently, energy projections have limited value for understanding the diverse ways that energy consumption might unfold in the future, and for analysing the potential of demand management. To provide a robust analysis of future possibilities, energy projections need to be complemented by broader exploratory and normative scenarios, as discussed in Section 5.3.4.

5.4.2 Energy price assumptions and treatment of renewable energy

In *E4cast*, the modellers set prices for internationally traded fuels (black coal and crude oil) and renewable energy exogenously, while the prices of electricity, natural gas and brown coal are determined endogenously (Dickson, Akmal & Thorpe 2003). In the 2001 projections, Dickson et al. (2001) assume that the real price of black coal will fall by 1.5 per cent a year to 73 per cent of its 1998-99 value by 2019-20. Real prices for brown coal, natural gas and electricity, determined within *E4cast*, are projected to fall by 2.3, 1.2 and 0.3 per cent a year respectively. In contrast, Dickson et al. (2001) assume real prices for renewable energy will remain constant over the projection period.

In effect, the 2001 projections assume that renewable energy will become even more expensive, relative to fossil fuels, than it is at present. This assumption is not supported by empirical evidence. The cost of wind power and photovoltaic power has fallen by roughly 20 per cent for every doubling of installed capacity. Rapid cost reductions are expected to continue in the commercialisation phase due to exploitation of scale economies (Grubler, Nakicenovic & Victor 1999; Oliver & Jackson 2000). Neij (1999, p.375) finds that 'the average cost of wind-generated electricity will almost be reduced by half by the year 2020'. In contrast, conventional fossil fuel technologies have used available scale economies to reach a position of dominance, and experience curves for these technologies indicate that cost reduction potential is much less than for renewable energy (IEA 2000). As a result, by 2019-20, real prices for renewable energy are likely to be significantly lower than they are now and the price gap between renewable energy and fossil fuels is generally expected to close, rather than widen.

In the 2003 projections, the modellers assume constant real prices over the projection period for black coal, crude oil, refined petroleum products, LPG and non-electricity renewables (biogas, biomass and solar hot water) (Dickson, Akmal & Thorpe 2003). By setting real prices at constant levels, the modellers have at least prevented a widening of the price gap between these renewables and fossil fuels, which is an improvement on the 2001 projections.

Other renewables (wind power and hydro power) are modelled in a separate electricity generation module of *E4cast*. Dickson, Akmal and Thorpe (2003) do not provide detail on assumed generating costs for different technologies in the electricity sector. While they state that assumed efficiency improvement rates are higher for newer technologies (e.g. wind power) it is not clear whether the specific assumptions used are adequate to ensure that the price gap between fossil fuel generation and renewable generation closes over time, as the empirical evidence demands. The model is not sufficiently transparent to allow this assessment to be made.

There is no evidence that ABARE has attempted to use experience curves or other methods to identify more realistic long-term price assumptions for different fuels. At best, it seems that the projections maintain the existing cost differential between fossil fuels and renewable energy, in spite of evidence that this differential will fall over the time period considered in the projections. Consequently, the reliability of the long-term fuel mix in the projections is questionable; it is likely to underestimate the contribution of renewable energy. Indeed, ABARE revised its projection of 2002-03 wind energy generation up from 0.9 PJ in its 2001 projections to 2.0 PJ in its 2003 projections, a change of 122 per cent, indicating that it did not anticipate the rapid growth in wind energy in Australia even in the short-term.

Dickson, Akmal and Thorpe (2003) provide a sensitivity analysis of the impact of different fuel price assumptions. They model alternative cases in which the primary fuel prices of natural gas, coal and oil are reduced by 10 per cent and increased by 20 per cent. They also model a case in which the end use price of petroleum products is 20 per cent higher. A 20 per cent increase in the primary price of natural gas, coal and oil only reduces PEC by 0.6 per cent over the projection period, illustrating the assumed inelastic nature of fuel demand. Similarly, a 10 per cent price reduction only increased PEC by 0.3 per cent, and a 20 per cent increase in petrol prices only reduced PEC by 0.9 per cent. None of these alternative assumptions resulted in a significant increase in the future uptake of renewable energy.

Of course, this sensitivity analysis relies on the assumed elasticities in the model, which are constant over the projection period. As discussed in Section 5.4.1, policy intervention can render these assumptions invalid and make the outlook for renewable energy much brighter. This again illustrates the importance of supplementing business as usual projections with alternative future scenarios to provide a comprehensive map of what is possible.

5.4.3 Future fossil fuel supply constraints

Both the 2001 and 2003 projections implicitly assume that there will be no physical or economic constraints on the availability of fossil fuels over the projection period. In 2000, Australia had economically recoverable black coal, brown coal and natural gas reserves sufficient to last 205, 611 and 49 years respectively (ABS 2000a). Physical or economic constraints on these fuels are unlikely over the projection period considered by ABARE, although Fainstein et al (2002) find that natural gas reserves in the Eastern states of Australia will be nearing depletion by 2019-20, necessitating imports from other states or countries. This should not, however, constrain total supply.

In contrast, recoverable crude oil reserves are sufficient for only 11 years at current production rates. Crude oil reserves fluctuated between 244 and 296 GL over 1991 to 2000, while annual oil production declined by 11.5 per cent (ABS 2000a). While the oil exploration industry has continued to discover and develop sufficient new oil fields to keep economically recoverable reserves relatively steady, declining production rates and increasing domestic oil demand mean that Australia is increasingly reliant on oil imports.

I discussed the possible implications of increasing reliance on imported oil in Sections 3.6.1 and 3.7.1. Of particular relevance here is the possibility of supply constraints due to peaking of global oil production, or other disturbances to import availability. The 1973 and 1979 oil shocks provided a preview of the effect that future oil supply constraints might have on energy consumption. In the United States, the oil shocks triggered a significant focus on energy efficiency and a permanent change in the relationship between energy use and economic output (Craig, Gadgil & Koomey 2002). As a result, earlier energy projections significantly overestimated future energy consumption (Craig, Gadgil & Koomey 2002). Similar shocks are certainly possible within the period covered by ABARE's projections. Nations that are net importers of oil, like Australia, may not be able to secure sufficient supplies of oil, or may need to pay substantially higher prices to compete for scarce oil supplies. If this is the case, then ABARE's assumption that real crude oil prices will remain constant over the projection period will be false and the projections will likely overestimate actual consumption of oil in Australia.[48]

Of course, it is far from clear how oil prices will fluctuate in the future, and ABARE's assumption is a reasonable response to this uncertainty. However, the sensitivity analysis of fuel price assumptions could have been improved by examining the impact of an increase in oil prices in the absence of increases in the prices of coal and natural gas, since there is a much greater likelihood of upward pressure on oil prices over the projection period.

5.4.4 Projection reliability: an exploration of energy system dynamics

Dickson et al. (2001) report that the mean absolute error for projections published by ABARE and its predecessors between 1981 and 1995 was below 5 per cent for all projections except the 1981 set. This is despite significant errors in some of the input assumptions to the projections, particularly those relating to oil prices (Walker 1996). This remarkable accuracy deserves closer examination for what it might reveal about energy system dynamics.

Trends in ABARE's projection error

Figure 5.1 shows the temporal variation in projection error for the eleven PEC projections prepared by ABARE and its predecessors between 1981 and 2001.[49] I define the projection error as the percentage difference between the projected PEC and the actual PEC. If the projection overestimated actual PEC, the projection error is positive; if it underestimated PEC, the projection

[48] In fact, since ABARE released its projections, oil prices have risen to US$50 per barrel compared to ABARE's assumption that real prices would remain constant at about US$30 per barrel.

[49] ABARE's predecessors were the Department of National Development and Energy (DNDE), the Department of Resources and Energy (DRE) and the Department of Primary Industries and Energy (DPIE).

error is negative. Figure 5.1 demonstrates that the projected PEC has rarely differed from the actual PEC by more than five per cent within the first 10 years of the forecast, with the exception of the 1981 projection. This verifies the error reported by Dickson et al. (2001). I will discuss the anomalous 1981 projection in more detail below.

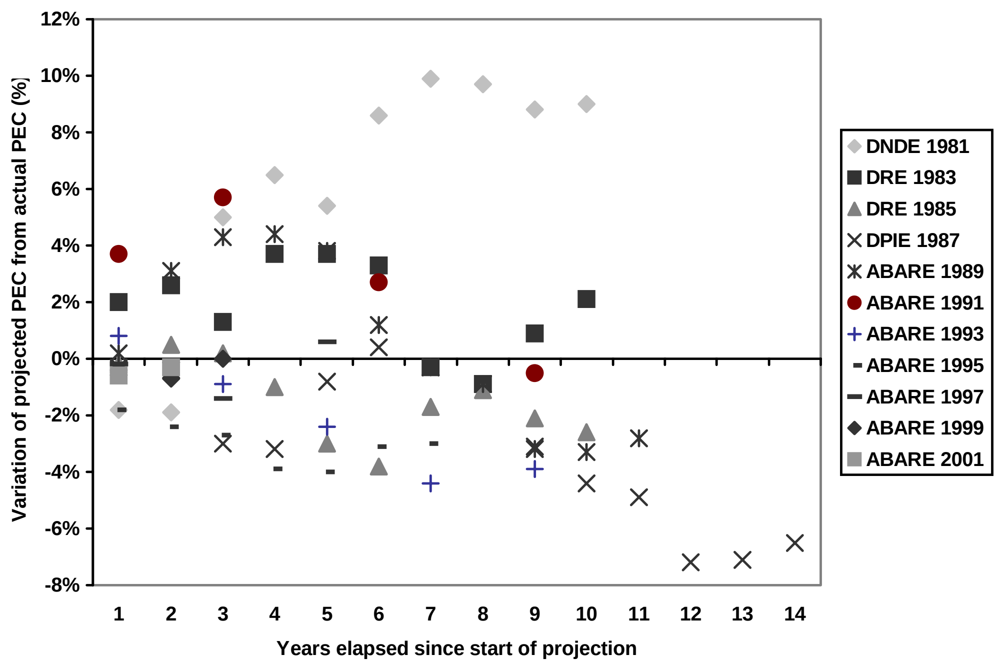

Figure 5.1: Errors in PEC forecasts by ABARE and its predecessors.

Only two projections (DPIE 1987 and ABARE 1989) were long enough and/or old enough to extend beyond 10 years in Figure 5.1, although another three reached 10 years (DNDE 1981, DRE 1983 and DRE 1985). The DNDE 1981 and DPIE 1987 projections, in particular, provide some evidence for a significant increase in error as the time horizon of the projection increases. This is consistent with a review of long-term energy forecasts in the United States by Craig et al. (2002), which showed that almost all forecasts covering a period of 20 years or more significantly overestimated energy consumption in 2000.

Figure 5.2 plots the average projection error for the eleven projections against time elapsed since the start of the projections. The average projection error is slightly positive in the first eight years of the projection but becomes negative for the first time in the ninth year and is increasingly negative beyond 10 years. That is, ABARE tends, on average, to slightly overestimate short to medium-term PEC, while underestimating long-term PEC. Figure 5.2 shows the number of error observations on which the average projection error is based to give an indication of the significance of the trend. The large negative errors beyond 10 years are based on one or two projections and do not necessarily constitute a significant trend.

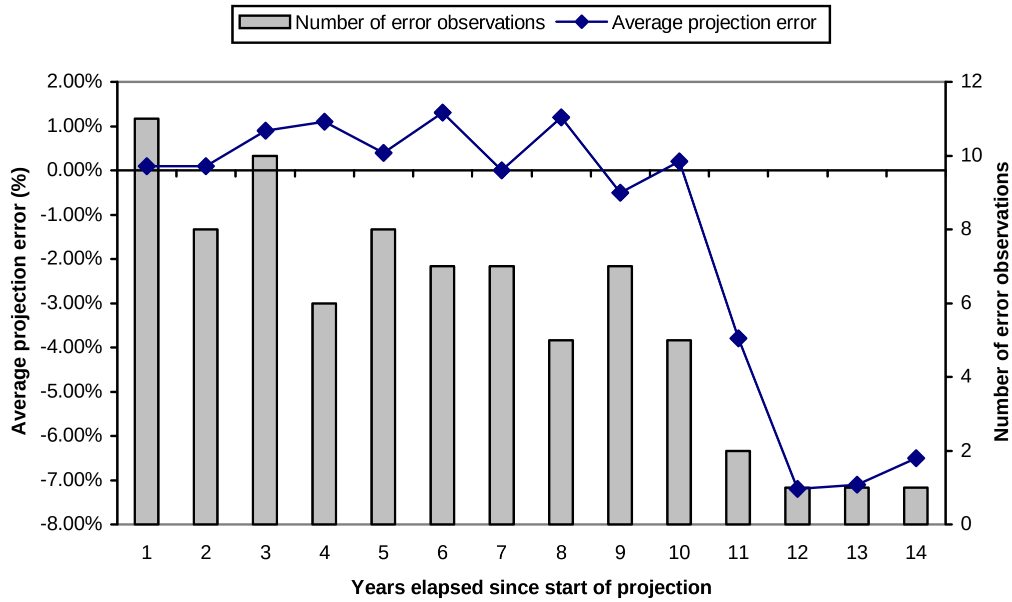

Figure 5.2: Trend in average projection error against time elapsed since the start of the projection.

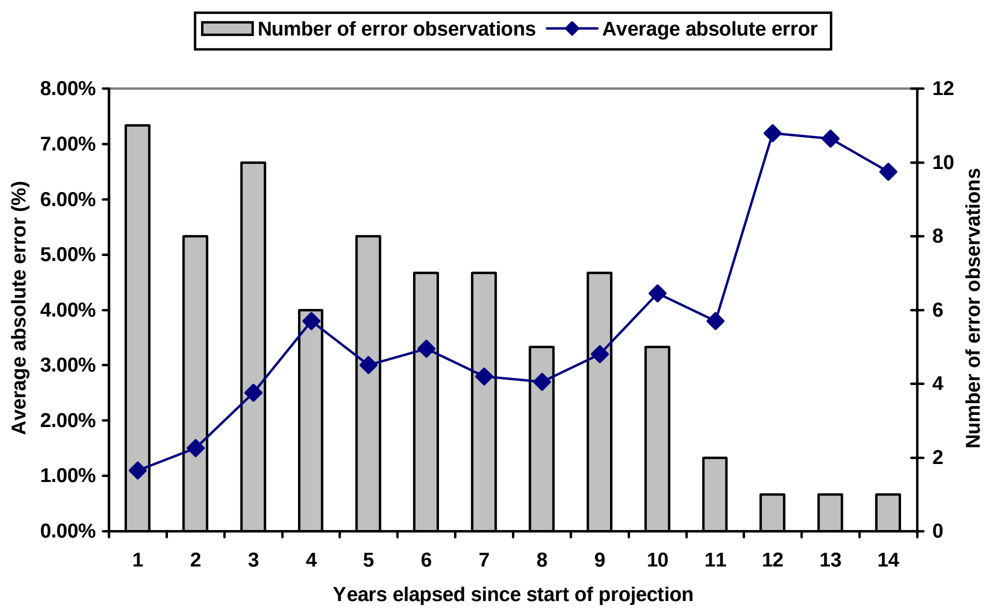

Figure 5.3: Trend in average absolute error of ABARE's PEC projections with years elapsed since the start of the projection.

Since Figure 5.2 plots average projection error, positive and negative errors in different projections cancel each other out, giving a false impression of universally low projection error over the first ten years. Figure 5.3 plots the same information using the average absolute projection error instead of the average projection error. The average absolute projection error shows an overall tendency to increase with the length of the projection. However, there is an evident stabilisation, and even a decrease, in the medium-term error. This pattern is surprising, as it would be reasonable to expect average absolute projection error to steadily increase over time due to increasing influence of unanticipated future developments. I will consider some possible explanations for this observation in later discussion.

Trends in ABARE's marginal projection error

In Figure 5.4, I provide another perspective on ABARE's projection errors by charting the temporal variation in marginal projection error for the same eleven sets of projections. I define marginal projection error as the percentage difference between the projected and actual change in PEC from the start of each forecast. Since investments in new infrastructure are driven by marginal demand, the marginal projection error is very important for energy sector planning. Figure 5.4 indicates that marginal error has been very high during the first three years for three projections – DNDE 1981, DRE 1983 and ABARE 1991. The marginal errors in these projections are so high that they obscure the marginal errors in all the other projections.

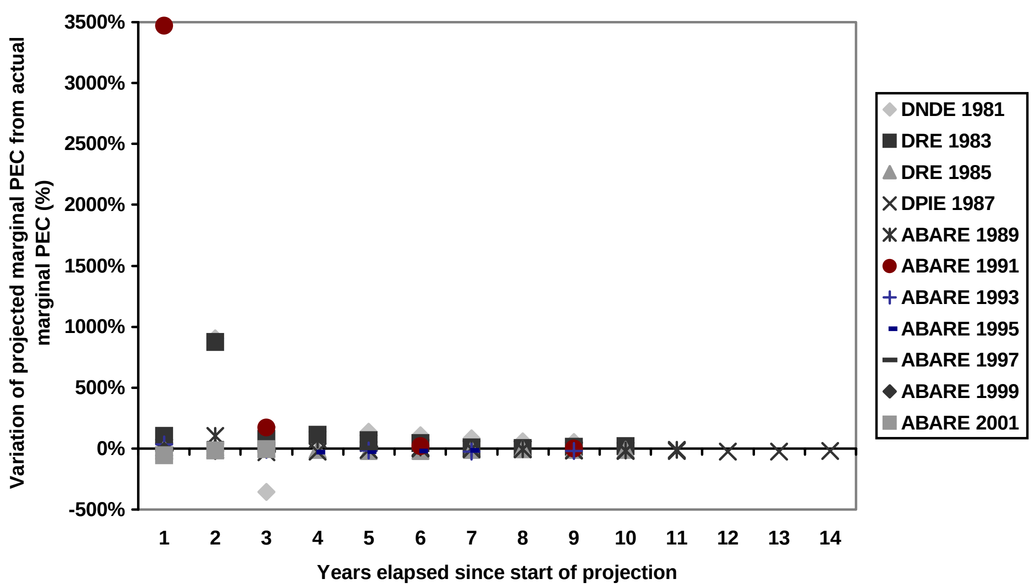

Figure 5.4: Marginal projection error in projections by ABARE and its predecessor organisations.

In Figure 5.5, I plot the average absolute marginal error to give a clearer impression of the overall error trend. The marginal error decreases over time, partly due to the increase in marginal PEC as time goes on (which increases the size of the denominator in the error calculation). However, it is also clear that particular projections contain serious marginal errors in the short-term. I propose an explanation for the high short-term marginal errors in particular projections in the discussion below.

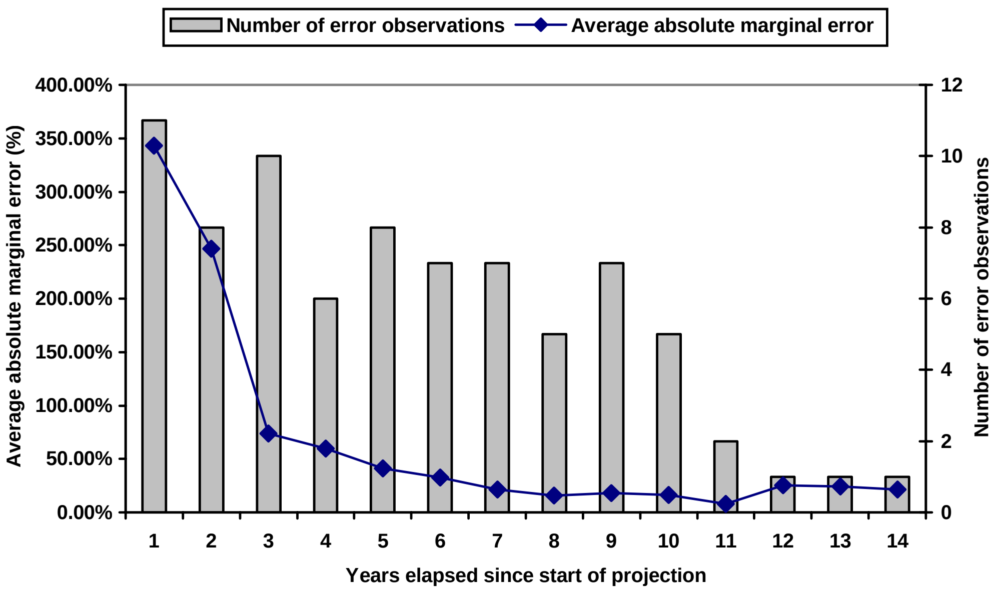

Figure 5.5: Trend in average absolute marginal error in PEC projections by ABARE and its predecessor organisations.

Implications for system dynamics

Walker (1996, p.483) notes the remarkable accuracy of ABARE's energy projections and argues that: 'This is an indicator of the slow pace with which structural change impacts on energy demand and the importance of the underlying drivers: population and economic growth'. There are two important points here. First, the energy system has significant inertia due to the large amount of infrastructure already installed. Energy demand associated with existing infrastructure makes up a very large proportion of the total PEC. Second, there are strong links between growth in energy demand and overarching trends in population and economic activity. These two points mean that, in the absence of significant shocks or innovations, it is actually not that difficult to track total PEC over time. This makes the accuracy of ABARE's projections over the first ten years less remarkable.

However, although ABARE's projections capture long-term trends in energy demand quite accurately, Figure 5.4 and Figure 5.5 demonstrate that they may significantly overestimate or underestimate marginal growth in PEC in the first few years of the projection. Further analysis of the data underlying Figure 5.4 and Figure 5.5 indicates that the largest marginal projection errors occurred during 1982-83, 1983-84, 1990-91 and 1991-92. Figure 5.6 plots the four projections with the largest marginal projection errors against actual PEC and annual GDP growth data from ABS (2003b). It is apparent from Figure 5.6 that 1982-83, 1990-91 and 1991-92 were years when annual GDP growth in Australia was negative or very low. Projections made immediately prior to these recession years significantly overestimated actual PEC in the short-term. However, three of the four projections still gave a relatively good estimate of PEC in the longer-term, after economic recovery.

The 1981 projections were an exception, substantially overestimating the long-term growth in energy demand.

Figure 5.6 indicates that ABARE's projections reliably capture changes in PEC due to long-term average economic and population growth trends, but fail to accurately capture the impact of short-term fluctuations in economic cycles, such as recessions. This observation helps to explain the pattern of errors in Figure 5.3 and Figure 5.4. The high marginal errors in the short-term are associated with projections made immediately before periods of unexpectedly low economic growth. Energy projections cannot allow for short-term economic fluctuations, which limits the breadth of futures they consider.

In the medium term, I would argue that the evident stabilisation in projection error in Figure 5.3 is a result of the averaging effect of long-term growth trends in population and economic activity. After recessions, strong economic recovery tends to return energy consumption to the levels projected by ABARE prior to the recessions. The medium-term accuracy of the PEC projections (Figure 5.1 and Figure 5.3) is also linked to the relative stability of underlying economic trends over the period considered. While there were some brief recessions, there were no major economic trend breaks, such as depressions or oil shocks. In the long-term, the inability to anticipate future developments causes the errors to increase again.

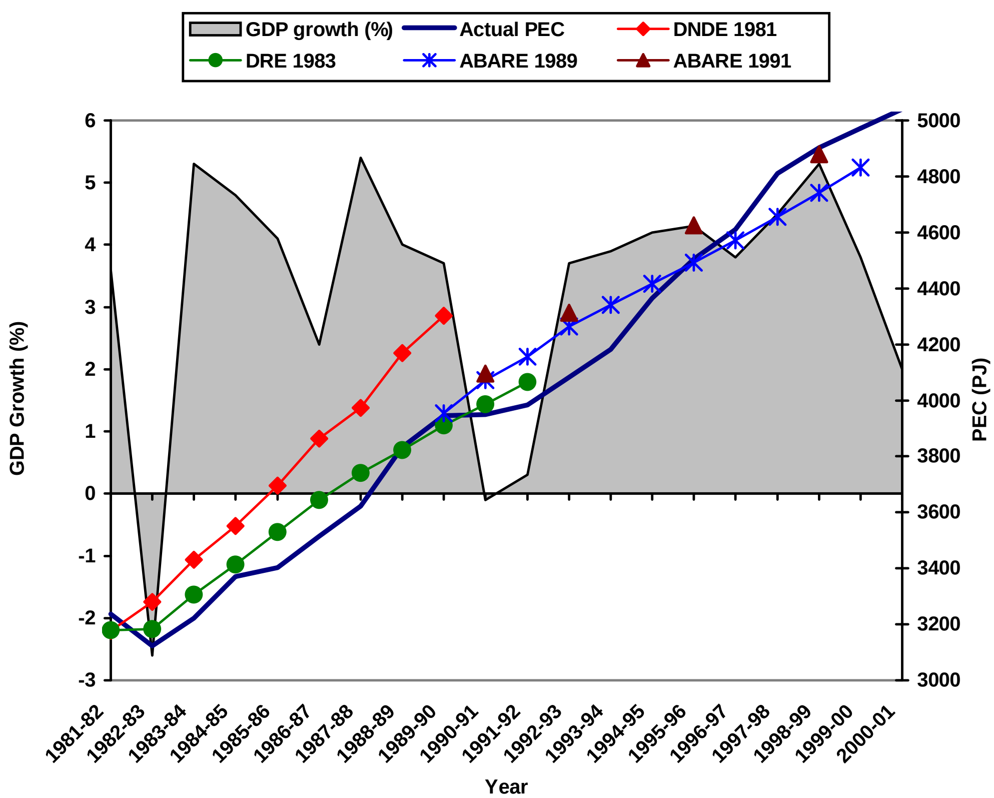

Figure 5.6: The effect of economic recession on ABARE's energy projections.

5.4.5 Discussion

My review of ABARE's modelling assumptions in Sections 5.4.1, 5.4.2 and 5.4.3 found that the validity of several of the assumptions is debatable. Other modellers might have chosen different assumptions and had different results. However, none of the assumptions are sufficiently problematic to render ABARE's projections invalid. Rather, my main conclusion is that any robust policy process concerned with the future structure of the energy system must rely on much more than a set of business as usual energy projections. At the very least, it would need to complement these projections with exploratory, and perhaps normative, scenarios to begin to map out the breadth of possible and desirable futures, as discussed in Section 5.3.4.

The exploration of energy system dynamics in Section 5.4.4 provides support for the argument in the literature (see Section 3.5.4), that the energy system has significant inertia, which makes rapid change in underlying energy consumption trends difficult. This inertia is linked to the large amount of infrastructure already in place and the importance of economic growth as the primary driver of growth in energy consumption. Over the period from 1981 to the present, there have been few major shocks or innovations affecting the relationship between economic activity and energy consumption in Australia. Ramos-Martin (2003) shows that predictive models can perform well in situations where uncertainty is reduced by stability and lock-in. Therefore, the reliability of ABARE's projections over the period considered may reflect nothing more than the reality of the technological and institutional lock-in described by Unruh (2000).

In my discussion of ABARE's energy price assumptions and treatment of future fossil fuel supply constraints, it became evident that projections of fuel mix are likely to be less reliable than projections of PEC. There are simply too many uncertain variables to allow accurate anticipation of the nature of structural change and the dynamics of fuel substitution within the energy sector. The projected fuel mix relies heavily on assumed fuel prices and elasticities, which are very difficult to accurately project over time. In addition, policies that initiate structural change in the energy sector, such as the MRET, can alter the fuel mix in ways that are not easy to anticipate using projections. For example, the unexpectedly rapid growth in wind power in Australia (see Section 5.4.2), partly in response to the MRET, is evidence that policy intervention by governments can prompt deviations from ABARE's projections. That is, even though the energy system has significant inertia, fuel substitution is possible with the right incentives.

As a result of the limitations described above, policy conclusions based solely on energy projections should be treated with caution. For example, it would be unwise for policy makers to conclude with certainty, based on ABARE's energy projections (or IEA projections), that energy demand will increase substantially over the next two decades and that most of this demand will be met by fossil fuels. Nevertheless, this very conclusion is common in the Australian energy policy network. For example, SESSWG (2004, p.40) uses ABARE's projections to support an argument that substantial investment in energy infrastructure will be necessary in Australia over the next two decades to meet growing energy demand. Similar arguments appear in the Final Report of the Energy Market Review (COAG 2002, p.62) and MCE communiqués (MCE 2003, p.2). In addition, the Australian Government has repeatedly stated that fossil fuels will continue to supply most of Australia's energy needs for the foreseeable future (e.g. DITR 2004, p.3; DPMC 2004, p.37).

As discussed in Section 5.2.3, these arguments are used to support Australia's subsidisation of low-emission fossil fuel technologies. One problem with a policy position based on energy projections is that it is not robust if alternative futures eventuate. If, for example, technical problems and widespread public opposition prevent the deployment of CCS technology, then Australia will be out-competed by countries that have pursued more diverse energy investment strategies and are able to offer cost-effective GHG emission reduction technologies to international markets. In addition, a policy position based on energy projections simply reinforces a business as usual future, rather than attempting to create a desirable future.

5.5 Vintage stock modelling: treatment of uncertainty

As discussed in Section 5.3.3, stock models are routinely used in Australia to assess the economic costs and benefits and impact on GHG emissions of policy proposals, particularly those relating to the stock of appliances, equipment, buildings and power stations. In this section, I will review the treatment of uncertainty in an Australian stock model developed by EES, through comparison with one stock model developed in the UK and one developed in the US. These three models are used for stocks of appliances, however, the issues are similar for stocks of buildings or power stations. As well as providing an exploration of treatment of uncertainty, the discussion in this section provides a conceptual framework for modellers considering the development of a stock model.

The Environmental Change Institute (ECI) in the UK developed its vintage stock model as part of the Domestic Equipment and Carbon Dioxide Emissions (DECADE) project and has continued to apply the model in subsequent projects (ECI 1995). Recent ECI modelling supported detailed policy scenarios for reducing domestic GHG emissions in the UK, Netherlands and Portugal (Fawcett et al 2000). In the US, the Department of Energy (DOE) uses a stock model developed at the Lawrence Berkeley National Laboratory (LBNL) to estimate national energy savings associated with proposed energy efficiency standards for domestic appliances (e.g. US DOE 2000, 2002).

The stock models developed by EES, the ECI and the US DOE use different modelling assumptions and parameter estimation methods, however, there are elements that are common to all the models. In Section 5.5.1, I outline the basic model equation used in all vintage stock models. In Section 5.5.2, I describe the different approaches to parameter estimation adopted in each model and categorise the models as either ownership/service life (OSL) models or stock accounting models. In Section 5.5.3, I consider the structure of OSL models in detail and in Section 5.5.4, I consider the structure of stock accounting models in detail. Finally, in Section 5.5.5, I discuss the findings of my review and what they reveal about responses to uncertainty. To assist in the analysis of the different stock models, I use an OSL stock model of my own construction to conduct various modelling experiments.

5.5.1 The model equation

Policy makers use stock models to project the annual energy consumption (*AEC*) of a stock of energy using or generating equipment over a range of future years. Although the terminology used in each of the three models is different, all rely on essentially the same model equation (Equation 1) to calculate the *AEC* in some future year *k*.

$$AEC(k) = \sum_{j=j_0}^{k} Stock(j,k) \times UEC(j) \times Time(k) \qquad (1)$$

Modellers need three parameters to calculate the *AEC*: *Stock(j,k)* is the total number of appliances sold in year *j* that are still in service at the end of year *k*; *UEC(j)* is the unit energy consumption of the appliances sold in year *j*, expressed as energy consumption per unit of time or operational cycle; *Time(k)* is the average time of appliance operation or number of operational cycles in year *k*. The year *j* steps from j_0, the year in which the oldest appliance still remaining in the stock in year *k* was sold, through to *k*.

5.5.2 Parameter estimation

None of the three parameters in Equation 1 are known with any certainty; modellers therefore need to estimate these parameters. The methods used to estimate *UEC(j)* and *Time(k)* are essentially the same in all three stock models. Where appliance efficiency is regulated, or appliances are labelled according to energy consumption, modellers draw on existing regulatory energy consumption tests to estimate the energy consumption of appliances on the market. *UEC(j)* is then the sales-weighted average energy consumption for appliances sold in year *j*. Where regulatory test results are not available, particularly for past years, estimates of *UEC(j)* may be developed by testing appliances of known age, or by interviewing appliance manufacturers. Estimates of *Time(k)* are usually developed from household surveys or research on consumer habits. For future years, projections of *UEC(j)* and *Time(k)* are developed for a reference scenario and one or more policy scenarios, allowing estimation of the impact on *AEC* of different policy proposals.

To estimate *Stock(j,k)*, the US DOE model divides the total stock between various ownership categories and uses a stock accounting model to track movement of stock between these categories over time. In contrast, the other two models use a time series of appliance ownership, an assumed appliance retirement function and the average service life of the appliance to estimate annual sales and the proportion of these sales remaining by any given year. These two distinct approaches are considered in more detail below.

5.5.3 Ownership/service life models

For convenience, I have categorised the EES and ECI models as **ownership/service life** models, since appliance ownership and average service life are the key parameters used to construct these models. I will consider the structure of OSL models below.

The OSL model equation

Both OSL models use Equation 2 to estimate *Stock(j,k)*, which is then used to solve Equation 1. In Equation 2, the appliances sold in year *j* that still remain in the stock at the end of year *k* are the product of the total sales in year *j* and a survival probability defined by an appliance retirement function, *Remain(j,k)*.

$$Stock(j,k) = Sales(j) \times Remain(j,k) \qquad (2)$$

In the UK, it is common for past appliance sales data to be unavailable or have missing values (Lane 2000). A similar situation applies in Australia. Where data are available, they often cover a short time span, have missing years or were collected using inconsistent methods. For example, reliable data on white good sales in Australia are only available over the period 1993 to 2001 (EES 2003). As many appliances in the stock were first sold in years for which sales data are unavailable, past annual sales must be estimated to solve Equation 2. Projections of future sales are also required.

Appliance sales vary markedly from year to year in response to economic cycles, climate and market conditions. The high variance of sales data makes accurate interpolation of missing values difficult. Therefore, the modellers do not try to interpolate between sales data points; instead they use a sub-model to estimate the full time series of sales and use actual sales data to calibrate the sub-model. The sub-models used by EES and ECI are different; I consider them separately below.

Sales estimation in the ECI model

The ECI model uses Equation 3 to estimate annual appliance sales in all years. In Equation 3, the sales in any year *j* are equal to the total stock at the end of year *j*, minus the total stock remaining from all previous years. The year i_0 (in Equation 3) is the year of sale of the oldest appliance still remaining in the stock in year *j*.

$$Sales(j) = Stock(j) - \sum_{i=i_0}^{j-1} Sales(i) \times Remain(i,j) \qquad (3)$$

Sales estimation in the EES model

The EES model uses Equations 4 and 5 to estimate annual sales in past years and only uses Equation 3 to estimate sales in future years (Lloyd Harrington 2003, pers.comm., 29 April 2003). In Equation 4, *Retirements(j)* is the total number of appliances that retire from the stock during year *j*. In Equation 5, *L* is the average service life, which is the average length of time between the purchase of a new appliance and its removal from the operating stock, either through failure or through early replacement and scrapping. Equation 4 also uses a retirement adjustment factor (*RAF*) to calibrate the model.

$$Sales(j) = Stock(j) - Stock(j-1) + Retirements(j) \tag{4}$$

$$Retirements(j) = \frac{Stock(j)}{L} \times RAF \tag{5}$$

Estimating total stock

To solve Equations 3, 4 and 5, the modeller needs data on the total stock at the end of each year, *Stock(j)*. In both OSL models, *Stock(j)* is estimated by multiplying the total number of households by the appliance ownership (appliances per household), as shown in Equation 6. The modellers source annual time series data on the number of households from government statistics.

$$Stock(j) = Households(j) \times Ownership(j) \tag{6}$$

Appliance ownership in any year is estimated by surveying a statistically significant sample of households to determine the average number of appliances in those households. However, ownership surveys are resource-intensive, so data is not usually available on an annual basis. Like the annual sales time series, the annual ownership time series is usually incomplete.

However, for most household appliances, the variance of appliance ownership is much lower than the variance of annual sales. While sales and retirements fluctuate substantially in response to economic conditions, climate and other factors, appliance ownership only changes gradually from year to year. This means that it is possible to interpolate missing ownership data with greater accuracy than missing sales data. I therefore interpret the structure of the OSL models as a response to scarce sales data in Australia and the UK.

Interpolating and extrapolating ownership

The two OSL models use different methods to interpolate missing ownership data. To illustrate, Figure 5.7 plots estimates of refrigerator ownership in Australia based on survey data alongside sample results for the two different interpolation methods. I have also plotted interpolation results from a third method (Gompertz interpolation), applied in other OSL stock models. I will discuss each of these interpolation methods in more detail below.

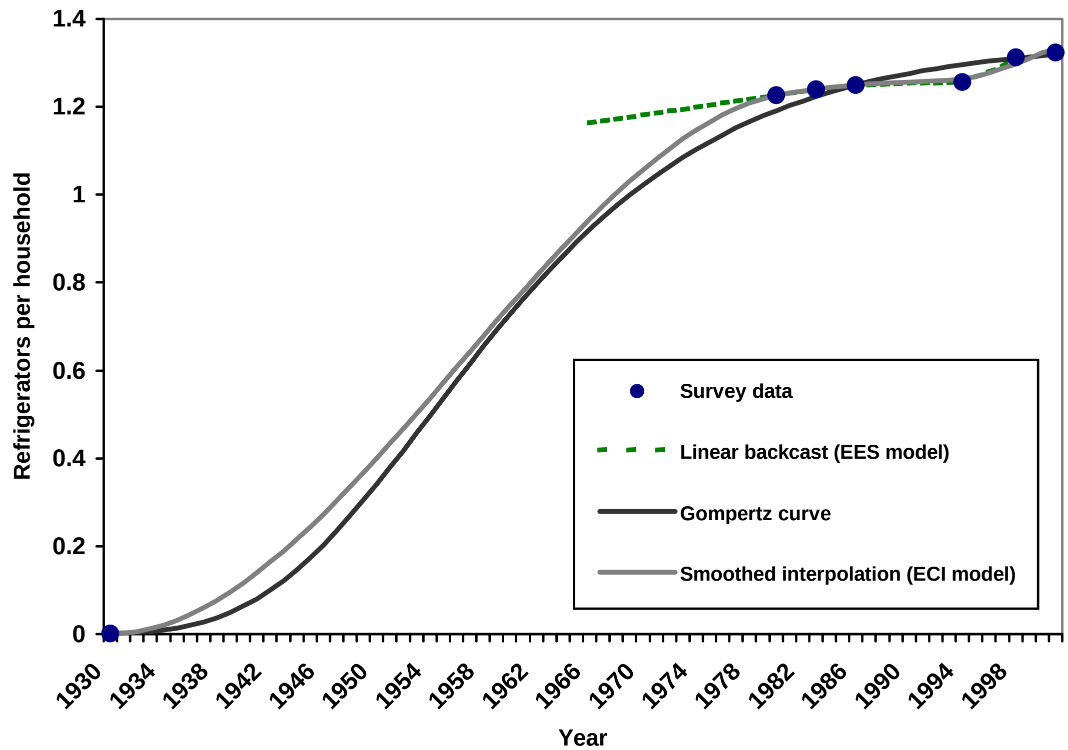

Figure 5.7: Different estimates of the refrigerator ownership time series for Australia.

The EES model uses linear interpolation to estimate missing ownership values, and linear backcasting[50] to extend ownership back to the model start date (1966). As linear interpolation relies on only two data points, it can amplify sampling noise, particularly when there are large gaps in the available data. Linear backcasting is also problematic. Growth in appliance ownership tends to follow an S-shaped curve. A linear backcast can rapidly diverge from this growth pattern, as shown in Figure 5.7.

To more realistically represent the actual pattern of ownership growth, stock modellers often fit an S-shaped growth curve to the available ownership data. Although not used in the EES or ECI models, a Gompertz growth curve (see Equation 7) is often used to represent growth in appliance ownership. In Equation 7, a and b are curve fitting parameters and S is the ownership at saturation. The ownership at saturation is assumed after analysis of current ownership trends. The first year of appliance sales, h_0, is estimated from historical documentation of appliance introduction. The curve fitting parameters are then estimated by linear regression, after conversion of Equation 7 to a linear equation.

$$Ownership\left(j\right) = Se^{-ae^{-b(j-h_0)}} \qquad (7)$$

[50] This is a different application of backcasting to that discussed in Section 2.5.3. In the EES model, backcasting refers to a backwards projection from the present into the past. More commonly, backcasting is undertaken from a desired future to the present.

Figure 5.7 shows a Gompertz curve fitted to data on refrigerator ownership in Australia, using 1930 as the start date for domestic refrigerator sales and assuming saturation at 1.35 refrigerators per household. As the shape of the Gompertz curve is based on all available data points, the curve provides a superior fit to that provided by the linear EES model.

Model results based on Gompertz curves are usually more sensitive to changes in S than changes in b_0 (see later discussion and Table 5.1). The ownership at saturation is also less certain in most cases, as it is a future projection rather than a historical fact. Since the model is sensitive to S, and S is less certain, the appropriate modelling response is to trial different S values in the regression to obtain the best least squares fit to available ownership data, while keeping b_0 constant. Once a Gompertz curve is fitted to available ownership data, it can be used to predict future ownership by extending the curve into the future. This is an advantage over other approaches, as long as the assumed ownership at saturation is accurate. However, Gompertz curves are only suitable for situations where ownership is growing steadily. If ownership of an appliance starts to decline due to substitution by another appliance, or the rate of growth changes markedly, a Gompertz curve will not provide an accurate fit to the data (ECI 1995).

An alternative approach, adopted by ECI, is to fit the ownership data using a smoothing and interpolation algorithm. The ECI model uses a low pass filter called the IRWSMOOTH algorithm to fit a curve to available ownership data and to interpolate missing data values (ECI 1995). Other smoothing and interpolation algorithms are available in commercial curve-fitting software.

Figure 5.7 gives the appliance ownership curve generated by smoothing available ownership survey data using a robust, locally weighted, scatter plot smooth and fitting a shape-preserving piecewise polynomial to the smoothed data. In contrast to the Gompertz curve, the piecewise polynomial preserves the pause in ownership growth implied by survey data over the 1990s. Interpolation and smoothing algorithms can cope with both growth and decline of ownership, which is a significant advantage over Gompertz curves. However, they must still assume a saturation level when used to project ownership.

Appliance retirement functions

Both OSL models use an appliance retirement function to solve Equations 2 and 3. The appliance retirement function, *Remain(j,k)*, gives the probability that an appliance sold in year *j* will remain in the stock in year *k*. In the ECI model, the probability function is a cumulative normal distribution with mean equal to the average service life of the appliance (Lane 2000). The EES model uses a linear approximation to the normal distribution, developed by the LBNL (Harrington et al 1999). The standard deviation used to define the distributions can vary, although four years is common for long-lived appliances like refrigerators. As long as the mean and standard deviation of the distributions are similar, the two distributions give similar results (see Table 5.1).

Average service life

The average service life of an appliance is required to define the distribution for the appliance retirement function. It is also used in the EES model to solve Equation 5. In the EES model, average service life is estimated using data from consumer surveys. However, consumer estimates of appliance age are not always reliable and survey data is often limited. For this reason, the ECI model estimates L numerically during model calibration. This involves varying L until the stock model gives the best least squares fit to available appliance sales and age data.

Model start date

To solve Equation 1, the stock model needs to extend back to the year j_0 in which the oldest appliance still remaining in the stock in year k was sold. To solve Equation 3, annual sales are required as far back as i_0, the year in which the oldest appliance still remaining in the stock in year j was sold.

The EES model only uses Equation 3 to estimate future sales. Equations 4 and 5 are used to estimate past sales, which are then used to solve Equation 3. As a result, j_0 equals i_0. Therefore, the EES model only needs to extend back to the year of sale of the oldest appliance in the stock in 1998, the year in which the model was developed. To accommodate an average service life of up to 21 years, the EES model extends back to 1966.

In contrast, the ECI model uses Equation 3 to estimate past as well as future sales. In this modelling approach, Equation 3 can only be solved for a particular year if annual sales in all previous years are known. This means that the model must extend all the way back to the first year in which the appliance was sold. As a result, i_0 will be earlier than j_0 for many common appliances. In the first year of sale, annual sales will equal total stock at the end of the year. Equation 3 is then solved by stepping forward a year at a time to build up the annual time series of sales.

Model calibration

The differing model structures result in differing approaches to calibration. The ECI model is calibrated by adjusting the average service life to provide the best least squares fit between estimated sales (from Equation 3) and actual sales and age data. Since data on appliance service lives is often poor, this approach to calibration ensures, appropriately, that the least certain parameter is the one that is varied.

The EES model is calibrated by varying the *RAF* in Equation 5 to provide a reasonable fit between model sales and actual sales data through the 1990s. There are two problems with this approach. First, it relies on estimates of average service life that may be quite uncertain. Second, it results in a discontinuity in the sales time series at the point where Equation 3 takes over from Equations 4 and

5. This is a particular problem when ownership is changing quickly (Lloyd Harrington 2003, pers.comm., 29 April).

Model sensitivity

Table 5.1 summarises the sensitivity of OSL models to different modelling assumptions, using models of refrigerators in Australia as an example. I have developed a model that uses a piecewise polynomial with i_0 = 1930 and S = 1.35 to interpolate ownership data, and an appliance retirement function based on a cumulative normal distribution, as the baseline model. This model closely approximates the ECI model. I varied the model assumptions as shown in Table 5.1 and examined the impact on sales and *AEC* over the period 2000 to 2030, for varying rates of *UEC* change, up to the rate associated with new refrigerator efficiency standards proposed for 2005 (see GWA & EES 2001). This rate was chosen because it represents a fast but realistic rate of *UEC* change prompted by the introduction of challenging energy efficiency standards. For each new set of assumptions, I recalibrated the model by changing the average service life. Many of the assumptions have a significant impact on estimated sales. The impact on *AEC* is smaller, as it depends more strongly on the total stock than the annual sales. However, the impact can be significant when compared to annual changes in *AEC*, which tend to be less than 0.5 per cent.

Variation in assumptions	Impact on sales	Impact on *AEC*
1% change in S	1% change in sales in year of saturation (same sign)	1% change in *AEC* in year of saturation (same sign)
Change in i_0 from 1930 to 1925, 1935 or 1940	Less than 1% change	Up to 0.1% change
Change from piecewise to Gompertz	Up to 9% decline	Up to 1% increase
Reduce service life from 19 to 17 years	Increase by up to 12%	Decrease by 2-4% depending on rate of future *UEC* change
Use approximation to normal distribution instead of normal distribution	Decrease by around 1%	Increase by no more than 0.5%
EES linear model with 1966 start date, L = 17 years, calibrated against sales and age data	Causes sales to oscillate (up to a 13.7% increase)	*AEC* oscillates (up to a 4.2% decrease)

Table 5.1: Sensitivity of an Australian refrigerator stock model to varying assumptions, for projections through to 2030.

The most significant change in *AEC* occurs when the EES modelling approach is adopted instead of the baseline (ECI) approach. The EES models causes sales and *AEC* to oscillate, with sales increasing by up to 13.7 per cent and *AEC* decreasing by up to 4.2 per cent. A decrease in *AEC* of this magnitude may be problematic when using the model to decide whether to adopt proposed efficiency standards. As the ECI model uses an approach to calibration that varies the least certain parameter, there is good reason to have more confidence in its results.

5.5.4 Stock accounting models

The US DOE model is a **stock accounting** model that divides the total appliance stock into ownership categories and tracks movement of stock between categories using probability functions. Typical ownership categories include: occupants of new housing; owners of appliances that have not had their life extended by repairs (regular appliances); owners of extended lifetime appliances; and non-owners (US DOE 2000, 2002). The OSL models only separate households into those with appliances and those without appliances.

The division into multiple ownership categories in the US DOE model is a way of recognising that the drivers for purchasing an appliance vary according to a household's circumstances. For a new household that does not own an appliance, the decision to purchase is not influenced by the condition of an existing appliance; it depends solely on the economic conditions and the utility of the appliance. On the other hand, households that already own an appliance will be influenced by the condition of their existing appliance when deciding whether to replace it.

The US DOE model also recognises that there are more events in the life cycle of an appliance than purchase, aging and retirement. Appliances may develop minor problems and be repaired, they may be extensively repaired or rebuilt so that their life is extended, or they may be replaced before they develop problems and enter the used appliance market. Intending purchasers of appliances may choose a new or a used appliance. Each household therefore faces a chain of decisions over time. This decision chain can be represented as a flow chart, as shown for a single ownership category in Figure 5.8. The rectangles are ownership categories and the arrows represent flows of stock during the year. Each of the diamonds in the flow chart is a decision point that can be modelled with a probability function.

Some of the decision probabilities are modelled using appliance retirement functions similar to that used in the OSL models. For example, the probability of an appliance developing problems is assumed to depend only on its age and the average service life, which can be modelled using a problem function that is similar to a normal distribution. However, most other decisions will be influenced by economic factors, such as price and operating cost elasticity. These decision probabilities are modelled using a standard econometric logit equation (see Equation 8).

$$\ln\left(\frac{P}{1-P}\right) = a + b \times Price + c \times OperatingCost + d \times FeatureIndex + ... \tag{8}$$

In Equation 8, *P* is the decision probability, and *a*, *b*, *c* and *d* are appliance-specific parameters. Consumer surveys, conjoint analysis[51] and data on historical appliance ownership provide initial estimates of the parameters. The model is then calibrated against annual appliance sales to give final parameter estimates. In the US, appliance sales data are collected by industry organisations. Recent model runs use a complete time series of sales over 1970 to 1996 (US DOE 2000, 2002). Without sales data of this quality, calibration of a stock accounting model to give accurate results would be difficult.

The model is implemented in a spreadsheet that applies the decision probabilities to existing stock categories and calculates stock in each category at the end of the year. Calculations are performed separately for each appliance age group and a year is added to the age at the end of the calculation. The result is the total stock in each age group at the end of each year, which is used to solve Equation 1.

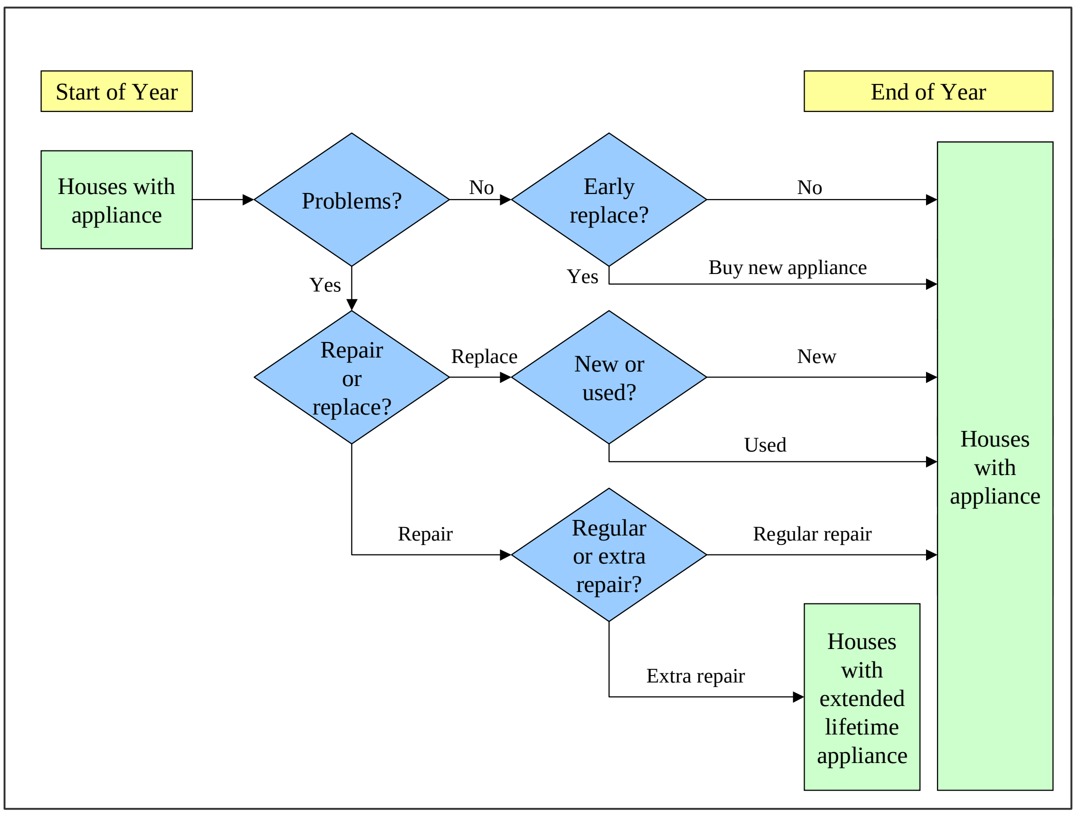

Figure 5.8: Partial flow chart for a stock accounting model.

Source: After US DOE (2000).

[51] This is a market research method used to determine the relative importance of different product features in a consumer's purchasing decision.

5.5.5 Discussion

When OSL models are used, results are influenced by the assumptions used to develop the model. An OSL model that uses a smoothing and interpolation algorithm to fit ownership data back to the year of introduction of an appliance appears to give the best approximation to reality under the broadest range of conditions. However, models based on Gompertz curves can provide comparable results when ownership is growing. If Gompertz curves or smoothing and interpolation algorithms are used, the model should extend back to the year of introduction of the appliance to give the best results.

The modelling approach used in the EES model has several problems. Although it removes the need to extend the model back to the year of introduction of the appliance, the trade-offs are reliance on uncertain data on appliance service life, and the creation of a sales discontinuity at the point where the projection model takes over from the historic model. The use of linear interpolation and backcasting also reduces the likely accuracy of this modelling approach. If a modeller intends to use an OSL model, the modelling approach used by ECI should give more reliable results.

Stock accounting models provide a more accurate representation of reality than that provided by the OSL models. These models recognise that different ownership groups will have different reasons for purchasing an appliance and that an appliance owner can respond to a faulty appliance in several ways. They also explicitly model economic conditions and consumer preferences. This gives greater predictive value and allows stock accounting models to be linked to different sets of economic projections. Future appliance ownership does not need to be assumed, as in an OSL model, but is determined within the model. Consumer preferences leading to appliance saturation are explicitly modelled.

In contrast, OSL models aggregate all behaviour into a single measure of ownership and a single probability of retirement. This does not necessarily mean that OSL models are less accurate at projecting future energy consumption, but it does mean that they provide less fine detail. The difference in *AEC* projections between the two model types has not been assessed due to a lack of Australian data. It can be noted, however, that the difference in projected energy savings will usually be less than the difference in projected *AEC*, as savings are based on comparisons between internally consistent scenarios. This will tend to reduce the impact of modelling assumptions.

The two different modelling approaches have, at least partially, developed in response to differing degrees of uncertainty. A long time series of sales data is available in the US, and conjoint analysis has been conducted to better understand consumer preferences. These data sets allow calibration of the probability functions in the stock accounting models. In the absence of reliable sales and consumer preference data, stock models based on ownership and average service life are the best alternative. This helps to explain their adoption in Australia and the UK where the quality of sales data is relatively poor.

While stock accounting models provide a more accurate representation of reality, it is not clear that the investment of time and money required to develop such a model is justifiable. The future will always remain unpredictable, no matter how many modelling improvements are implemented. Rather than investing in model improvement (beyond the level reached by the ECI model), I believe that policy makers would do better to allocate scarce resources to actual climate change response programs and prioritise institutional learning through evaluation programs. This will provide a stronger basis for future policy development than any attempt to improve the predictive power of stock models. I will return to this point in Chapter 8.

5.6 The *Turbulent World* scenarios: a brief review

As noted in Section 5.3.4, the Strategic Energy Supply and Security Working Group established by the MCE commissioned a consortium of consultants to develop a set of four exploratory energy supply and demand scenarios for Australia (NIEIR et al 2003; SESSWG 2004). The consulting team comprised 'technologists, economists, as well as strategy, energy and marketing specialists' (NIEIR et al 2003, p.5). The *Turbulent World* scenarios produced by the consultants were developed to comply with specific terms of reference established by SESSWG.

The terms of reference specified four scenarios. The first called for: 'Strong global economic growth fuelled by increasingly open trade and investment' (NIEIR et al 2003, p.16). In the final report, this condition is met in the *Global Convergence* scenario, describing a future in which continued global economic growth and free trade lead to convergence of global living standards. According to the consultants, this scenario is the closest to a normative scenario but, for various reasons, has a relatively low probability of occurrence (NIEIR et al 2003, p.88). These reasons include the evident global resistance to neo-liberal ideologies and the continuing importance of protective trade blocs, such as the European Union.

In the second scenario: 'World economic growth [is] constrained by increased protectionism, recession in the region, conflict in the Middle East impacting on oil supplies from that region and oil prices, and a breakdown in the global efforts to address climate change' (NIEIR et al 2003, p.17). In this *Fortress World* scenario, the push towards globalisation falters and the economic divide between developed and developing countries deepens, leading to conflict and environmental degradation. According to the consultants, this scenario is compatible with the dynamics of existing global trends, although it assumes there is no emergence of high quality leadership to steer the world away from this undesirable future (NIEIR et al 2003, p.99).

In the third scenario: 'Strong global economic growth [is] sustained by significant advances in technology, including a much greater deployment of renewable energy technologies' (NIEIR et al

2003, p.17). This scenario, called *It's a Green World*, assumes stronger support for environmental imperatives. Economic growth is briefly reduced, but is greater in the long-term. The consultants believe that this scenario has normative elements and a reasonable probability of actually occurring as a way of avoiding the *Fortress World* future. It requires strong leadership and acceptance of static living standards in some countries during the transition phase (NIEIR et al 2003, p.104).

In the final scenario, there is: 'Moderate global economic growth, with growth sustained in Australia by the adequate availability of energy supplies and services from indigenous sources, including gas, delivering robust development in both urban and regional areas' (NIEIR et al 2003, p.17). This *Muddling Through* scenario combines the themes of the second and third scenarios at various times and for limited periods, resulting in moderate economic growth. This scenario is the closest to a current trends scenario, and therefore most similar to the future quantified in ABARE's energy projections.

These four scenarios are undoubtedly useful for expanding the range of possible futures considered during energy policy development, providing a basis for more robust policy decisions. Both NIEIR et al. (2003) and SESSWG (2004) draw out important economic, technological and political findings from the scenarios for consideration in energy policy development. However, there is much that is missing from the scenarios and the methods used to develop them; an integral perspective helps to reveal these omissions.

First, the multidisciplinary team assembled to prepare the scenarios does not span the quadrants. As noted above, the scenario authors describe themselves as technologists, economists, strategy, energy and marketing specialists. None of the authors describe themselves as members of the epistemic communities that address the subjective quadrants; there are no psychologists, sociologists or cultural theorists, let alone artists or ethicists. From my review of the final report, the team is clearly skilled in analysis of the objective quadrants, particularly the systemic quadrants. However, the analysis of the subjective quadrants is less convincing, seemingly relying more on populist accounts than academic research on values, discourses and worldviews. The inclusion of representatives from the subjective disciplines in the scenario development team would undoubtedly have added depth to the analysis of values and discourses, thereby strengthening the final scenarios.

Second, the consultation process used as an input to the scenarios favoured business and industry interests. The report lists stakeholders consulted during the scenario development process (NIEIR et al 2003, p.234). Of 76 stakeholders listed, 60 (79 per cent of the total) were from energy or technology businesses, large energy users or industry associations. Another ten were from government. The remaining six stakeholders included two from environment groups (the Total Environment Centre and the Australian Conservation Foundation) and four academics with an interest in environmental and social issues. While the number of stakeholders consulted may not be a good indicator of the weighting given to particular concerns in the scenarios it is sure to impart a particular perspective on the analysis. From my involvement in Australian energy and greenhouse policy issues, I am aware of numerous other academics, environmental campaigners and community advocates that could have provided very different perspectives on the future to those provided by business interests.

Third, there was a conspicuous lack of public involvement in the scenario development process. The scenarios are strongly expert-driven, with consultation limited to energy sector stakeholders. This significantly limits the range of perspectives and insights that are included in the scenarios. Encouraging public involvement in scenario development is one way of starting to access the subjective quadrants. I will return to this point in Chapter 8.

Finally, it is problematic that the central elements of the four scenarios were imposed through the initial terms of reference rather than emerging from the process. The initial scenario definitions drive the scenario builders to interpret and structure their qualitative and quantitative data according to pre-existing categories. To improve understanding of the breadth of possible futures, I would argue that categories must be allowed to emerge from the data. This leaves the process open to insights that may be closed off by early imposition of structure.

Despite these limitations, the *Turbulent World* scenarios provide a superior basis for policy decisions in the energy sector compared to economic analyses and energy projections alone. I believe that such processes have great potential as part of an integral response to climate change, particularly with the specific improvements suggested above.

5.7 Conclusion: an integral assessment of Australia's climate change response

As noted in Section 5.1, my main intention in this chapter was to clarify the nature and limitations of current policy practices as the starting point for a transition to an integral policy response. I have considered both the content of Australian energy and greenhouse policy and the processes and tools used to develop that policy. In this concluding section, I provide an integral assessment of Australia's climate change response.

In this chapter, I reviewed the main policy processes and tools used in Australia to develop energy and greenhouse policy. These include economic analysis, energy projections, stock models, exploratory and normative scenarios, parliamentary and public inquiries and various consultative processes, including requests for submissions, confidential meetings and bargaining by interest groups. From an integral perspective, each of these policy development methods has value but also has limitations. I will discuss the possible role of each method in an integral climate change response below.

Economic analysis is useful for determining the most appropriate allocation of resources to meet established policy objectives. However, at least in the case of climate change response, it is not an appropriate tool for identifying policy objectives. Deep uncertainty about the future impacts of climate change makes it impossible to accurately quantify and compare the costs and benefits of climate change in monetary units. In addition, economic theory is based on the dubious assumption that people and firms always act rationally to maximise utility. Further, economic analysis is often used in the realm of energy and greenhouse policy to support an unquestioned ideological commitment to economic growth, associated with modern, rational values. Applied in this way, economic methods do not admit alternative subjective values and worldviews, including postmodern and integral values. Consequently, over-reliance on economic analysis in energy and greenhouse policy decisions becomes a barrier to an integral climate change response. Other authors confirm the over-reliance on economic modelling in Australian energy and greenhouse policy (Diesendorf 1998) and international climate policy (Cohen et al 1998).

Economic analysis also obstructs an integral climate change response when its results are presented as facts, without sufficient explanation of the subjective modelling choices and assumptions that underpin those results. Economic modelling results are often used this way in the Australian climate policy network (Henman 2002). Insufficient qualification of modelling results is exacerbated by a lack of transparency in model descriptions. Each modelling assumption is a choice that closes off a range of possible and desirable futures. These futures may be of vital interest to those affected by the policies that are being modelled. In an authentic democracy, it is appropriate to allow public scrutiny of such choices. If economic analysis is to be included in an integral climate change response, it needs to be opened up to public participation.

Energy projections are a type of economic analysis, equally subject to the above criticisms. By assuming continuation of existing trends, relationships and institutional structures into the future, projections capture a future that excludes trend breaks and perpetuates technological and institutional lock-in. Considered in context, as a quantitative description of a single possible (but fragile) future, an energy projection may be a useful planning tool. However, on their own, energy projections do not provide sufficient information about the breadth of possible futures to support robust planning decisions. They become problematic when presented as factual descriptions of the future and accepted at face value by policy makers, as is commonly the case in Australian energy policy documents (e.g. COAG 2002, pp.60-62; DPMC 2004, pp.36-40).

Stock models are less ambitious than economic analyses or energy projections, attempting only to model energy consumed by a particular stock of appliances, equipment, buildings or power stations. Implemented as spreadsheet models, they are flexible policy analysis tools that can consider multiple policy scenarios affecting a particular energy using or generating stock. As with the other models discussed above, they can become problematic when results are presented as factual rather than exploratory. However, the stock models I have reviewed are less prone to this problem than economic models or energy projections. Although relatively simple models, they are sufficient for comparison of the objective costs and benefits of policy options within particular economic sectors.

The three tools discussed above model technological, economic and ecological[52] systems and are associated with the systemic quadrant. The exploratory scenarios developed by NIEIR et al (2003) attempt a broader coverage of the developmental lines in the systemic quadrant, adding social, political and institutional drivers for alternative futures to technological, economic and environmental drivers. Indeed, the scenario builders sought to address elements of the subjective quadrants by giving (limited) consideration to cultural norms and values and their role in alternative futures. Unfortunately, the scenario development process offered no opportunities for public involvement and catered particularly to business interests, so the final scenarios capture only a limited range of subjective perspectives. Nevertheless, with public involvement and stronger representation of subjective epistemic communities in the scenario development team, exploratory scenarios can be used to include objective and subjective perspectives in an integral response to climate change. The state support for the development of the *Turbulent World* scenarios is significant and may indicate a greater willingness on the part of energy policy makers to grapple with future uncertainty.

Two of the *Turbulent World* scenarios had strong normative elements. Organisations associated with the greenhouse action discourse coalition have developed their own normative scenarios (Saddler, Diesendorf & Denniss 2004; Turton et al 2002). These scenarios offer an alternative policy vision that challenges the business as usual policies modelled through economic analysis and energy projections. Alternative scenarios coming from outside the state provide the type of discursive contestation sought by Dryzek (2000). While they may not always change policy, they challenge the assumptions and worldviews of the resource-based discourse coalition and, optimistically, may encourage reflection and deliberation. However, these normative scenarios did not benefit from public input and participation. Consequently, while they give voice to an alternative discourse, they may exclude other important discourses. Without public involvement, normative scenarios lack democratic authenticity and exclude plurality.

Public inquiries and reviews provide an avenue for public involvement in policy decisions, however the degree of public impact and engagement delivered by such processes is relatively low. Deliberation undoubtedly occurs within inquiry or review panels, however, such panels are not chosen to be representative of community views. Deliberation outside these panels is constrained by the focus on individual submissions. Individuals writing submissions do not have their views directly challenged by other participants; there is no site for discursive contestation and no trigger for reflection. In addition, access to the resources required to effectively participate in such processes is uneven and skewed towards business interests. Members of the public rarely have time

[52] Limited to quantification of GHG emissions.

to develop sufficient knowledge in policy areas to support a considered response and are provided with little support to develop such knowledge. Groups representing community and environmental interests are poorly resourced relative to groups representing business interests. This situation, combined with an ideological commitment to economic growth, makes business interests within the resource-based discourse coalition paramount in Australian energy and greenhouse policy.

Other consultative processes suffer from the same problems. They focus on collecting stakeholder views and providing information about decisions. Typically, the terms of the debate are already framed. There is little scope for citizens to define the terms of the debate themselves. The Australian public has not been asked to deliberate on desirable energy and greenhouse futures, to identify preferred energy technologies, or to establish normative policy objectives. Current policy development practices cater primarily for business interests and modern values, excluding broader public interests and diverse subjective perspectives and limiting potential for development of mutual understanding across discourses.

It is apparent that objective tools and methods, instrumental rationality and modern values are dominant in the specific case of Australian energy and greenhouse policy. This finding is consistent with the general findings of other authors (e.g. Dryzek 1990; Jamison 2000; Wilber 2000c) and is reflected in policy content. Above, I discussed the ideological commitment to economic growth that is central to Australian energy and greenhouse policy. This commitment is apparent in the evolution of Australia's policy of no-regrets, described by Bulkeley (2001), and in the arguments used by the Australian Government to defend its position on the Kyoto Protocol (see Section 5.2.2) and its long-term greenhouse policy (see Section 5.2.3).

The dominance of objectivism and instrumental rationality is also evident in prioritisation of technological solutions. Jamison (2000, p.252) notes that: 'Among influential decision-makers in most societies, there is still a dominant belief in an autonomous instrumental logic, which tends to include a bias towards the most advanced technologies and a reduction of problem solutions to "technical fixes". The Australian Government's commitment to low-emission fossil fuel technologies, particularly CCS, is consistent with Jamison's argument. Indeed, in the leaked LETAG meeting minutes, the Prime Minister specifically stated that he was looking for a low-emission energy fund 'focused on accelerating Super Dooper technology progress' (Walsh 2004, p.1).

The focus on technological solutions is symptomatic of a deep reluctance on the part of decision-makers to address the fundamental structural, institutional and cultural issues that underlie the climate change problem. If a technological solution can be found, then decision-makers can avoid difficult ethical questions about the relationship between developed and developing countries and the sustainability of Western lifestyles. However, if not addressed in the context of climate change response, these sustainable development concerns will only arise elsewhere in other forms. An integral response to climate change must be consistent with a response to broader civilisational concerns. To date, the Australian Government has performed particularly poorly on this front. Its arguments against ratification of the Kyoto Protocol show no sensitivity to ethical principles. They are sociocentric arguments in which protection of the wealthy Australian lifestyle is prioritised over a worldcentric ethical responsibility to developing countries.

In Chapter 4, I identified academic work addressing the psychological and cultural quadrants, including work on discourse and deliberative democracy. There is no indication that this academic work has influenced energy and greenhouse policy practices in Australia. Australian energy and greenhouse policy practices show all the indications of being trapped in Wilber's flatland. Of the work considered in Chapter 4, deliberative or discursive democracy seems to offer particular potential for an integral policy response to climate change. Numerous authors have described the theoretical and empirical benefits of public dialogue and deliberation in the context of policy development (e.g. Bohman 2000; Dryzek 2000; Fung & Wright 2001). These theorists and practitioners of deliberative democracy identify benefits that include improved quality and legitimacy of policy decisions, strengthening of civil society and civic values and improved policy outcomes as a consequence of accessing a wider range of perspectives and harnessing public knowledge and creativity.

The inclusive goals of deliberative democratic theorists resonate with those of integral theorists. An integral response to climate change needs to accommodate 'the variety of ways in which human beings can experience the world…in an open and evolving political order' (Dryzek 2000, pp.72-73). It should encourage democratic contestation 'by a broad variety of competent actors under unconstrained conditions' (Dryzek 2000, p.77). This implies understanding the variety of discourses that are relevant to energy and greenhouse policy and providing sites for discursive contestation and deliberation on policy. I will identify relevant discourses in Chapter 7 and propose practices to encourage contestation and deliberation in Chapter 8.

6. Energy and Transport Subsidies in Australia

Subsidies and externalities, social as well as environmental, affect energy markets. With few exceptions, these subsidies and externalities tilt the playing field towards conventional sources of energy. This presents a clear case for public-policy intervention that would encourage the research, development and adoption of renewable forms of energy. Policy intervention, in concert with ongoing private investment, will speed up the process of sorting the wheat from the chaff in the portfolio of feasible renewable energy technologies.

- Hall et al (2003) in *Nature*

6.1 Introduction

In Section 4.13.3, I noted a lack of information on the nature and magnitude of energy and transport subsidies in Australia. As discussed in Section 3.7.3, the cost of delivering energy services using renewable energy sources is currently greater than the cost of delivering those services using fossil fuels in most applications. While fossil fuels have some natural advantages due to their concentration and ease of storage and transport, much of the cost differential is an artefact of historical path-dependent processes in the energy system. In many countries, the distribution of public energy subsidies has been identified as one of the factors contributing to the cost differential between fossil fuels and renewable energy (UNEP 2003). In this chapter, I examine the magnitude and distribution of energy and transport subsidies in Australia to gauge their impact on the relative prices of fossil fuel and renewable energy. The guiding research question is:

- Does the existing system of energy and transport subsidies in Australia create a significant market distortion in favour of fossil fuel production and consumption?

I have several specific objectives in pursuing this question. First, if Australian energy and transport subsidies do create a market distortion in favour of fossil fuel production or consumption, then removal or redistribution of subsidies can potentially deliver economic and environmental benefits. In economic terms, removal of subsidies improves economic efficiency. Alternatively, funds used to subsidise fossil fuels could be used to support renewable energy, allowing industry development without net budgetary impacts. In environmental terms, removal of fossil fuel subsidies will, according to economic theory, result in higher fossil fuel prices and consequent reductions in fossil fuel demand. An IEA study found that subsidy removal in eight non-OECD countries could increase GDP of those countries by almost 1% and lower CO_2 emissions by 16% (IEA 1999).

Second, I believe it is in the public interest to have full disclosure of the uses of public funds. The public is often unaware of the existence and magnitude of subsidies. Indeed, the government may not be fully aware of the extent to which existing funding programs and taxation arrangements support fossil fuels. An objective of this chapter is to provide transparency in allocation of public funds to different energy and sources.

Finally, I attempt in this chapter to engage with the dominant economic ideology that permeates Australian energy and greenhouse policy. Of the many policy proposals that could be advocated as a way of responding to climate change, removal of fossil fuel subsidies is the most consistent with the imperatives of neoclassical economic theory and neo-liberal market philosophy. In attempting to constructively engage across discourses, subsidy removal may be a good place to start.

I start my analysis, in Section 6.2, by considering previous work on subsidies in Australia and internationally. In Section 6.3, I consider subsidy definition and identification. In Section 6.4, I identify different subsidy categories, with different priorities for removal. In Section 6.5, I assess electricity subsidies and in Section 6.6 I assess other stationary energy subsidies. In Section 6.7, I analyse transport subsidies. Finally, in Section 6.8, I summarise Australian energy and transport subsidies and draw conclusions in relation to the research question and objectives discussed above. Throughout this chapter, estimates of the magnitude of subsidies are for 2003-04, in Australian 2003-04 dollars, unless otherwise stated.

6.2 Previous work on subsidies

In 1996, the National Institute of Economic and Industry Research was engaged by the Commonwealth Department of Environment, Sport and Territories (now the Department of Environment and Heritage) to examine subsidies to the use of natural resources in Australia (see NIEIR 1996). NIEIR encountered 'conceptual as well as practical difficulties in getting the data…[which meant that the study]…developed as more of a discussion document and less as a catalogue of hard figures' (NIEIR 1996, p.iii). Despite these difficulties, NIEIR estimated financial subsidies to the Australian energy and transport sectors at $1.995 billion (in 1994 dollars). However, NIEIR did not fully distinguish between subsidies to fossil fuels and subsidies to renewable energy, so their report does not allow a conclusion to be drawn about possible market distortion in favour of fossil fuels. Further, it is reasonable to expect that the range and magnitude of energy and transport subsidies will have changed significantly since 1994, given the program of energy market reform pursued since that date.

In November 2000, the Senate Environment, Communications, Information Technology and the Arts References Committee released the final report of its inquiry into Australia's response to global warming (ECITA Committee 2000). The report estimates direct fossil fuel subsidies at $2 billion per year, citing NIEIR (1996), but identifies an additional $4 billion in indirect subsidies such as 'tax incentives, startup grants, preferential purchasing agreements for oil, and biased market structures' (ECITA Committee 2000, p.xxxvi). The report also identifies Commonwealth subsidies of $360 million per year for renewable energy programs (ECITA Committee 2000, p.xxxvi). While the source of these estimates is not stated, they are apparently derived from summation of specific subsidies reported to the inquiry in hearings and submissions. However, as I will discuss in Section 6.3, there is often inconsistency in the way subsidies are defined. The ECITA Committee made no attempt to ensure that all subsidy estimates reported to it were based on a consistent definition and benchmark, so the accuracy of the overall estimate is questionable.

Several Australian studies have been published independently since I commenced the research reported in this chapter (Hamilton, Denniss & Turton 2002; Laird et al 2001; Turton 2002). Hamilton, Dennis and Turton (2002) consider environmental taxes and charges, Laird et al (2001) consider transport subsidies and Turton (2002) considers subsidies to aluminium smelters. None of these studies attempt a comprehensive overview of energy and transport subsidies. Where appropriate, I incorporate estimates from these studies alongside my own estimates developed as part of this research.

International studies on energy and transport subsidies do not disaggregate data sufficiently to identify the magnitude of Australian subsidies.[53] Estimates of global fossil fuel subsidies range from $US151 billion to $US235 billion per year (de Moor 2001; UNEP & IEA 2002). Between 1994 and 1998, the OECD (2003) estimates that subsidies to energy and transport in OECD countries amounted to US$16 billion and US$40 billion per year, respectively. In this context, the ECITA Committee estimate of a $6 billion annual subsidy to the energy sector in Australia would constitute a significant proportion of total OECD subsidies.

It is apparent from this brief review that the magnitude and distribution of Australian energy and transport subsidies remains uncertain. Existing comprehensive estimates are either dated, fail to adequately distinguish between subsidies to fossil fuels and subsidies to renewable energy, or suffer from the lack of a consistent subsidy definition. Inconsistent subsidy definition also makes it difficult to combine partial subsidy estimates from other studies. My first task in this chapter, then, is to outline a consistent subsidy definition to underpin a more comprehensive analysis of energy and transport subsidies in the deregulated energy sector. This is the focus of Section 6.3.

6.3 Subsidy definition and identification

Identification of energy and transport subsidies requires a consistent definition of what constitutes a subsidy. This, in turn, requires the definition of a benchmark or baseline against which to assess deviations in energy costs and prices. In this section, I will outline my choice of subsidy definition (Section 6.3.1) and benchmark (Section 6.3.2) to guide this research. In Section 6.3.3, I will distinguish between financial subsidies and externalities. In Section 6.3.4, I will outline a typology of

[53] The Earth Track web database (Earth Track 2004) provides information on government interventions in energy markets, including specific Australian data, but does not estimate the magnitude of the subsidies associated with these interventions.

subsidies based on their different forms of implementation. Finally, in Section 6.3.5, I will define the scope of the subsidy analysis in this chapter.

6.3.1 Defining energy and transport subsidies

There is no universally accepted definition of what constitutes a subsidy. Several authors trace the history of the debate over the concept (e.g. de Moor 2001; OECD 2003). I will not discuss that debate here. Instead, I will adopt the widely accepted definition of an energy subsidy developed by the International Energy Agency:

> [An energy subsidy is] any government action that concerns primarily the energy sector that lowers the cost of energy production, raises the price received by energy producers or lowers the price paid by energy consumers (UNEP & IEA 2002, p.9).

Expanding on this definition, a fossil fuel subsidy is any government action, concerning primarily the energy sector, that lowers the cost of fossil fuel production, raises the price received by fossil fuel producers or lowers the price paid by fossil fuel consumers. Similarly, a renewable energy subsidy is any government action that lowers the cost of renewable energy production, raises the price received by renewable energy producers or lowers the price paid by renewable energy consumers.

Some authors provide more specific subsidy definitions that are useful for identifying particular types of subsidy. In the transport sector, Porter (2003, p.75) finds that:

> A transport subsidy could be defined either in terms of the gap between government expenditures to transport systems and the revenues collected from those systems (cost recovery) or by the failure to internalise external costs and other marginal social costs (congestion, scarcity, accidents, operating costs) in a specific mode of transport.

Porter (2003) argues that the choice of definition depends on the issue being addressed. In part, the choice depends on whether financial subsidies or externalities are of interest. I will consider this distinction in Section 6.3.3. In estimating transport subsidies in Section 6.6.11, I will primarily apply Porter's first definition of a transport subsidy, but will also discuss transport externalities.

In this chapter, I draw on estimates of subsidies from the other sources discussed in Section 6.2, each of which defines a subsidy slightly differently to the IEA definition presented above. For example, NIEIR states that a subsidy arises 'when a government deliberately adds to the revenue or relaxes the financial performance criteria of a productive entity to enable it to sell its outputs at less than the real costs incurred in producing those outputs' (NIEIR 1996, p.14). Whereas the IEA definition mentions financial benefits for producers and consumers, NIEIR's definition mentions only benefits for producers. Definitional differences like this one can make direct comparison and transfer of subsidy estimates difficult. In later sections, where I draw on subsidy estimates by other authors, I specifically consider the impact of definitional differences and adjust subsidy estimates as appropriate to match the IEA subsidy definition.

6.3.2 Defining the benchmark

The IEA subsidy definition implicitly conceptualises a subsidy as a deviation of costs or prices from some benchmark situation. De Moor (2001) notes that choosing this benchmark is crucial for accurate estimation of subsidies. Theoretically, the benchmark situation is that in which private welfare is maximised – an equilibrium state of Pareto optimality. Any deviation of prices from marginal private costs therefore implies a subsidy. In practice, the world market price is commonly used as the benchmark for identifying domestic subsidies for traded goods. Deviation of domestic prices from the world market price indicates the existence of a subsidy. For goods that are not traded, the price charged can be compared with the unit cost of production to identify whether cost recovery is occurring (de Moor 2001).

Australia trades black coal, oil and natural gas internationally, so any gap between the domestic and world market prices would be indicative of a subsidy for these fuels. Brown coal and renewable energy sources are not traded internationally so, for these fuels, prices could be compared to the cost of production to identify subsidies. However, while top-down comparison of domestic prices with world prices can indicate the presence of a subsidy, it does not facilitate identification of specific subsidies and the regulatory instruments or policies that support them. I have therefore adopted a bottom-up approach to subsidy identification in this chapter, using cost recovery as a benchmark. This approach supports identification of specific energy and transport subsidies in an Australian context, which is a prerequisite for subsidy reduction, redistribution or removal.

6.3.3 Financial subsidies and externalities

In Section 3.7.3, I identified three factors, unrelated to any natural advantage of fossil fuels over renewable energy, that could potentially create market distortion in favour of fossil fuels. The first two factors are historical and current patterns of subsidisation within the economic system that favour fossil fuels over renewable energy. I refer to these factors as **financial subsidies**. The third factor is the exclusion of various environmental and social costs of fossil fuel production and consumption from the economic system. These costs are treated as **externalities**. I will outline the distinction between financial subsidies and externalities below.

Financial subsidies are cost or price distortions that are included in existing accounting frameworks and affect energy prices in the market. They decrease the cost of energy production and/or consumption and therefore, assuming there is some price elasticity of demand[54], will encourage an increase in the activity level of economic actors involved in the activities that are subsidised. When the activity that is subsidised is an environmentally disruptive one, such as fossil fuel production and consumption, financial subsidies will increase the degree of environmental disruption. Subsidies to fossil fuel production and consumption will prompt an increase in fossil fuel combustion and

[54] The demand response prompted by a change in energy prices is generally inelastic, i.e. a given percentage increase in price results in a smaller percentage decrease in demand. However, there is still a demand impact.

GHG emissions above the benchmark level. In this chapter, I will focus primarily on financial subsidies.

Externalities are costs and benefits that are excluded from accounting frameworks and market prices. Negative externalities are costs that are not fully paid by the actors responsible for incurring the costs. The costs may be shifted to other specific actors, to the public, or to future generations. For example, the costs of climate change are not currently included in fossil fuel prices; they are borne by the global community and future generations. Since the actor producing or consuming the fossil fuels does not pay all costs, their level of activity is higher than it would be if all costs were included. That is, the failure to include all negative externalities in markets is a type of subsidy according to the IEA definition discussed in Section 6.3.1.

In Section 3.7.2, I outlined the problems with arriving at an accurate monetary estimate of the full cost of climate change. As a consequence of deep uncertainty about future climate change impacts, I argued that it is not possible to develop a meaningful estimate of the full magnitude of fossil fuel externalities. However, it is possible to develop lower-bound estimates of energy externalities by valuing those climate change costs and other environmental and social costs that are reasonably well understood. The European Commission's ExternE study is an example, providing estimates of the magnitude of energy externalities in the European Union (see Krewitt (2002) for a recent review of ExternE and European Commission (2001) for comprehensive results). Similarly, NIEIR (1996) estimated the subsidies associated with negative environmental externalities in the Australian energy and transport sectors at between $4.076 and $5.196 billion per year.

Although negative externalities undoubtedly contribute to the price differential between fossil fuels and renewable energy, my primary purpose in this chapter is to determine whether financial subsidies also contribute significantly to the price differential. The mechanisms for including negative externalities in market prices are well understood, and include the market instruments (emission taxes and emissions trading) discussed in Section 3.7.4. The mechanisms for addressing financial subsidies in Australia are less understood, as they depend on the different methods of implementation for different subsidies. I therefore concentrate on financial subsidies in this chapter, while noting that where financial subsidies are associated with negative environmental and social externalities, environmental and social disruption will tend to be magnified (NIEIR 1996).

6.3.4 A typology of financial energy subsidies

Several authors provide typologies of financial subsidies in general (e.g. de Moor 2001; WTO 1999), or energy subsidies specifically (e.g. IEA 1999; UNEP 2003). In the sections below, I draw on all of these authors to outline a typology of financial energy subsidies.

Direct financial transfer

Direct financial transfers include grants to producers and consumers and low-interest or preferential loans to producers (UNEP 2003, p.22). They can be implemented as explicit subsidies, rebates, grants, equity infusions or other payments. Direct financial transfers are usually the easiest type of subsidy to identify as governments usually report their existence and magnitude in annual budget papers. However, subsidies of this type may not be universally disclosed, or may be aggregated with other budget items, which can make identification difficult.

Tax expenditure

A tax expenditure 'is a tax concession that provides a benefit to a specified activity or class of taxpayer' (Australian Government 2004g, p.1). Tax expenditures provide preferential tax treatment for particular entities. Preferential tax treatment may include tax credits, accelerated depreciation allowances on energy supply equipment or rebates or exemptions on royalties, sales taxes, producer levies and tariffs (UNEP 2003, p.22). In the energy and transport sectors, tax expenditure often takes the form of differential tax rates on different fuels or tax credits for specific actors (IEA 1999).

The complexity of the taxation system can make identification of subsidies implemented through tax expenditure difficult. Under the *Charter of Budget Honesty Act 1998*, the Australian Government publishes an annual *Tax Expenditures Statement* (TES) that estimates the budgetary impact of tax expenditures. This is the main source of information on tax expenditure subsidies for this analysis.

To estimate the cost of a tax expenditure to the public, a taxation benchmark needs to be identified against which favourable tax treatment can be assessed (Howard Pender, pers.comm., 2001). Any deviations from the benchmark are then defined as tax expenditures. The 2003 TES provides a detailed discussion of the appropriate taxation benchmark for Australia (Australian Government 2004g). The definition of a taxation benchmark requires a degree of judgement as to which aspects of the taxation system are intrinsic features of the system and which are deviations. Consequently, any proposed taxation benchmark is contestable. For consistency, I have followed the Australian Government's definition of the taxation benchmark, defining subsidies as any tax expenditures that create deviations from that benchmark.

However, the design of the tax system (i.e. the taxation benchmark) itself can encourage fossil fuel production or consumption. For example, Douglas (2002) identifies design features of the Australian taxation system that discourage expenditure on the environment; it is reasonable to expect that there are also design features that encourage fossil fuel use. Therefore, according to the IEA definition of a subsidy, the design of the tax system could create subsidies to fossil fuel production and consumption. I will discuss design features of the tax system that may act as subsidies where appropriate.

When considering subsidies that are administered through the taxation system, it is important to also consider any special taxes, such as resource rent taxes, that are imposed on fossil fuel producers and consumers. These special taxes can offset the impact of subsidies. According to the UNEP and IEA, most OECD countries more than offset any gross energy subsidies with special taxes and duties on fossil fuels (UNEP & IEA 2002).

Energy-related services provided directly by government at less than full cost

The public provision of goods and services below cost is a form of subsidy. Examples include direct government investment in energy infrastructure, energy-related services provided by publicly funded agencies and public contributions to research and development (R&D). This category of subsidies includes operation of public agencies and public infrastructure to achieve less than the normal rate of return on investment.

Infrastructure subsidies are often delivered as part of confidential commercial contracts between governments and private businesses, making them difficult to identify. Detailed examination of budget papers can reveal that particular public agencies are not recovering the cost of their services, however, it can be difficult to determine what proportion of that cost should be paid by particular groups, such as fossil fuel producers. Public contributions to research and development are easier to identify.

Capital cost subsidies

Capital cost subsidies include preferential loans (soft loans), loan or liability guarantees, debt forgiveness (de Moor 2001) and interest rate subsidies (IEA 1999). Complex financial arrangements and commercial protection of details of capital provision can make identification of these subsidies difficult. Provision of capital at less than market rates can be identified by comparing the actual cost of capital to the subsidised entity to the cost of capital for a comparable unsubsidised entity. Judgement is required to identify an appropriate benchmark.

Trade restrictions

Trade restrictions, such as quotas, technical restrictions and trade embargoes, raise the cost of production for entities outside the country applying the restrictions, thereby lowering the relative cost of production for domestic producers (UNEP 2003). The benchmark for identifying a trade restriction is usually defined as a global free trade economy. Some trade restrictions may serve an important public good purpose and are not always suitable for removal, at least in the short-term.

Energy sector regulation

Government regulation of the energy sector can create subsidies through demand guarantees, mandated deployment rates, price control, market access restrictions and procurement policies (de Moor 2001; UNEP 2003). For example, there may be a regulatory requirement to purchase a given amount of fuel from a specific source at a regulated price or price controls to promote supply and consumption of particular energy sources (IEA 1999). The benchmark for identifying these subsidies is usually defined as a free market economy. Again, it should be noted that energy sector regulation often serves an important public good purpose and subsidies of this type are not always suitable for removal.

6.3.5 The scope of this analysis

As noted in Section 6.3.3, my focus in this chapter is on domestic financial subsidies to energy and transport. Where appropriate, I also consider economic structural incentives that are not strictly subsidies, such as incentives resulting from the design of the taxation system. I am primarily interested in subsidies funded from general taxation revenue. I discuss several cross-subsidies that have no net impact on government spending, however, I do not usually attempt to estimate the magnitude of these subsidies, as I am interested in the total magnitude of public support for fossil fuels and renewable energy. The list of subsidies discussed in this chapter is not intended to be exhaustive. Instead, it provides a foundation for ongoing analysis.

To structure the chapter, I have divided subsidies into categories based on the sector in which they apply. I consider subsidies for the generation and use of electricity in Section 6.5, other stationary energy subsidies in Section 6.6 and transport subsidies in Section 6.7. It is not possible to perfectly divide subsidies according to these categories, as some subsidies provide support for multiple categories. Where this is the case, I discuss each subsidy in the first relevant section and apportion the magnitude to different sectors as appropriate. In each of these sections, I consider both fossil fuel subsidies and renewable energy subsidies. For many subsidies, such as those for electricity generation, this requires allocation of a portion of the subsidy to fossil fuels and a portion to renewable energy. I describe allocation methods in the relevant sections.

As the focus of this chapter is primarily on stationary energy and the cost differential between fossil fuels and renewable energy, I have not attempted a comprehensive review of all subsidies to all transportation modes. I do consider road transportation subsidies in detail, from a cost recovery perspective, but do not attempt a similar analysis for public transport, cycling or walking. Strictly speaking, I am interested in the relative costs of fossil fuels and renewable energy; an analysis of cycling and walking makes no contribution to understanding those costs. An analysis of public transport could make a contribution and would be an appropriate focus for further research. Public transport is primarily fuelled by fossil fuels in Australia, so the exclusion of public transport from the analysis favours fossil fuels.

In developing subsidy estimates, I have not included the substantial costs associated with maintaining access to international petroleum fields and protecting shipping routes through military action. Koplow and Martin (1998) review estimates of the annual cost to the United States of defending Persian Gulf oil supplies and find a range from $US10.5 to $US23.3 billion. Recent developments in Iraq would presumably have increased this cost. Although the Australian military presence in the Persian Gulf is much smaller, I would argue that a portion of Australia's military spending could be justifiably allocated to the protection of oil supplies and shipping routes.

As a result of these exclusions, and the use of conservative assumptions throughout, I consider the fossil fuel subsidy estimates in this chapter to be lower-bound estimates.

6.4 Subsidy categories and removal priorities

According to economic theory, subsidies distort the operation of markets and therefore reduce economic efficiency. Advocates of free markets argue for the removal of all subsidies to allow markets to operate efficiently and effectively. However, as discussed in Section 6.3.3, markets do not always consider environmental and social objectives. Further, as discussed in Section 3.7.2, energy markets typically suffer from market failure. Given these problems, government intervention in markets in order to meet environmental and social objectives is justified. Subsidisation is one form that this intervention can take.

According to the UNEP and IEA (2002, p.19): 'Any subsidy can be justified if the gain in social welfare or environmental improvement that it brings exceeds the net economic cost'. Consequently, not all energy and transport subsidies should necessarily be removed, including some of those that support fossil fuel producers and consumers. Those subsidies that provide gains in social welfare or environmental improvement that are greater than their economic cost can justifiably be retained.

To determine which subsidies supporting fossil fuel production or consumption are candidates for removal, I categorise each identified subsidy according to the scheme shown in Figure 6.1. The rectangle in Figure 6.1 denotes the boundary of the economic system; financial subsidies and structural incentives are internal to the economic system, whereas externalities are external to the economic system. The outer ring in Figure 6.1 denotes the boundary between fossil fuel subsidies that create deviations from the benchmark and structural incentives that are part of the benchmark, such as design features of the taxation system. Tax reform to remove structural incentives may be justified where it will improve economic efficiency, reduce GHG emissions and facilitate social equity.

All of the subsidies within the outer ring reduce the cost of producing or consuming fossil fuels. Economic theory indicates that a reduction in the price of fossil fuels will encourage greater use of fossil fuels, and therefore greater GHG emissions. Most fossil fuel subsidies will therefore tend to be environmentally harmful and a case can be made for their removal on environmental grounds. However, in some cases, the negative environmental impact may be offset by other environmental gains. For example, the provision of government funding to fossil fuel producers for research and development (R&D) constitutes a fossil fuel subsidy that reduces the cost to the fossil fuel producer of doing the R&D, and therefore reduces the total cost of fossil fuel production. The subsidy will act as a driver for higher GHG emissions. However, if the R&D is focused on GHG emission reduction, then the net impact of the subsidy may be a reduction in GHG emissions below the benchmark level.

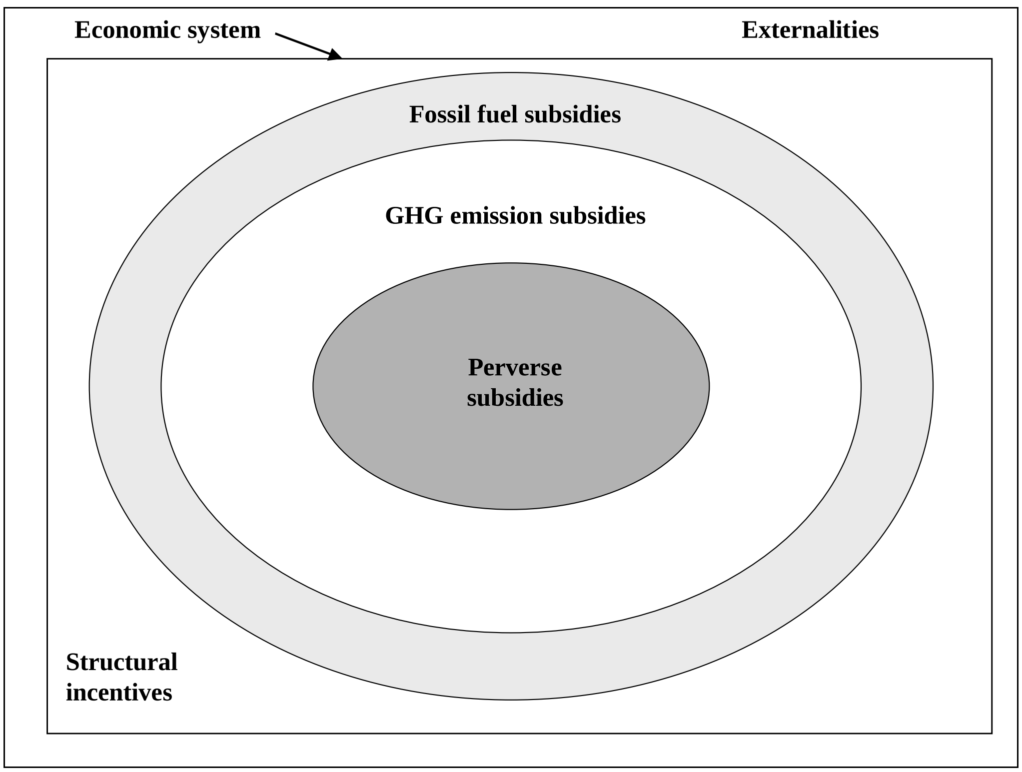

Figure 6.1: Categorisation system for fossil fuel subsidies and incentives.

The complete set of fossil fuel subsidies can therefore be divided into those that subsidise greater GHG emissions and those that are likely to result in a net decrease in GHG emissions. In Figure 6.1, the second ring includes the fossil fuel subsidies that create a net increase in GHG emissions above the benchmark situation; I have labelled these **GHG emission subsidies**. In the area shaded light grey are those fossil fuel subsidies likely to create a net decrease in GHG emissions.

For many fossil fuel subsidies, the net effect on GHG emissions is relatively clear and identification of GHG emission subsidies is possible without detailed calculations or modelling. For other fossil fuel subsidies, the net effect is less certain. Pieters (2003) outlines a checklist for determining whether the removal of a subsidy will have significant environmental benefits. As a first attempt at identifying those fossil fuel subsidies that may be a priority for removal, I have applied the following questions from this checklist:

- Are there other policies in place that effectively limit the impact of the subsidy on total GHG emissions?
- Are more benign alternatives available now, or are they likely to be available in the future?
- Is the magnitude of the subsidy sufficient to have a significant impact on GHG emissions?

These questions help to identify fossil fuel subsidies that are likely also to be GHG emission subsidies. However, in some cases, the status of particular subsidies remains uncertain without detailed economic modelling or GHG emission calculations. I have not undertaken such modelling or calculation work in this chapter, as I am primarily interested in developing a preliminary estimate of the magnitude of subsidies to determine whether further work on subsidy removal is justified.

The case for removal of GHG emission subsidies is clearly stronger than the case for removal of all fossil fuel subsidies. However, some GHG emission subsidies may meet other public objectives, such as regional development or employment; removal of such subsidies needs to be carefully considered against these other objectives. In addition, removal of some GHG emission subsidies may have a negative impact on social equity. Intelligent policy design is needed to ensure that any fuel price rises associated with subsidy removal do not exacerbate existing inequalities. For example, rebates or tax credits for low-income households are a policy option to counter the social impact of uniform fuel price rises. There may also be few current alternatives to fossil fuels in some applications, so GHG emissions subsidies may need to be maintained while alternatives are developed. In other words, subsidy removal must seek a balance between environmental, social and economic objectives. Where the negative social or economic impacts of subsidy removal prove intractable, there may be a strong case for leaving a GHG emission subsidy in place.

Within the subset of GHG emission subsidies, there is a smaller group of **perverse subsidies**, shown inside the inner circle in Figure 6.1 (shaded dark grey). Myers and Kent (1998) define perverse subsidies as those that are detrimental to both the environment and the economy in the long run. I have extended their definition to comprise subsidies that are detrimental to the environment, economy and *social equity* in the long run. Perverse subsidies have few redeeming features and are almost always suitable targets for removal on the grounds of improved economic efficiency, reduced environmental impact and/or improved social equity. I attempt a preliminary categorisation of subsidies as perverse, using considered judgement rather than detailed modelling or policy analysis. Detailed analysis to confirm the categorisation of subsidies I have identified as perverse would be an appropriate focus for further research. My categorisation of a subsidy as perverse does not remove the need to carefully consider the design of any subsidy removal program to ensure that particular groups in society are not disadvantaged.

Using the categorisation shown in Figure 6.1, perverse subsidies are the highest priority for removal, as long as steps are taken to minimise any resulting social disruption. Removal of other GHG emission subsidies is a lower priority, but may be justified if the environmental gains that result are seen to outweigh the economic and social objectives met by the subsidy. This is a matter for public debate and depends on the weighting given to different objectives. Fossil fuel subsidies that are not GHG emission subsidies are the lowest priority for removal.

However, there are arguments against using fossil fuel subsidies as a mechanism for achieving GHG emission reductions. Although these subsidies may achieve short-term GHG emission reduction, they provide support to an industry that will need to be gradually phased out if long-term targets consistent with atmospheric stabilisation are adopted. As discussed in Section 5.2.3, the long-term emission reduction potential of technologies like CCS is limited; these technologies also have significant levels of financial, technical and environmental risk. I would argue that long-term climate change response is better served by allocating available funding to development of technologies with greater long-term emission reduction potential and lower levels of risk, including renewable energy and energy efficiency.

A decision on whether to remove all fossil fuel subsidies, even those that achieve short-term GHG abatement, depends on the weighting given to long- and short-term environmental objectives. A government focused on a short-term GHG reduction target may decide that subsidising fossil fuel producers and consumers to reduce emissions is the most rapid and cost-effective way to achieve the target. A government guided by a long-term objective of responding effectively to climate change may choose to invest available funding in developing alternatives to fossil fuels, rather than in fossil fuel subsidies. In this case, removal of all fossil fuel subsidies will be a higher priority.

6.5 Electricity subsidies

In this section, I consider subsidies that support generation or use of electricity. In some cases, these subsidies provide support for electricity generated from a specific source, allowing direct allocation of the subsidy as a fossil fuel (FF) subsidy or renewable energy (RE) subsidy. In other cases, the subsidy is for use of electricity from the grid, which means that a proportion of the subsidy supports fossil fuels and the remainder supports renewable energy. In these cases, I have divided the subsidy in proportion to the average shares of fossil fuels and renewable energy in Australian electricity generation. Fossil fuels supply about 92 per cent of all electricity generation in Australia and renewable energy sources supply about 8 per cent of electricity generation (Akmal et al 2004). Table 6.2, in Section 6.5.8, summarises the magnitude and categorisation of the electricity subsidies that I have considered in this research. Research and development subsidies in the electricity sector are considered as part of the stationary energy estimates in Section 6.6.4.

6.5.1 Subsidised supply of electricity to aluminium smelters

The aluminium smelting industry is an electricity-intensive industry that consumes almost 15 per cent of all electricity consumed in Australia and accounts for about 5.9 per cent of Australia's total greenhouse gas emissions (Turton 2002). This proportion is set to increase with the construction of a new Comalco alumina refinery and the Aldoga Aluminium Smelter at Gladstone in Queensland, due to commence operations in 2005 and 2007 respectively. Australian aluminium smelting has the highest GHG intensity in the world, due to the heavy reliance on coal-fired electricity (Hamilton 2004).

Turton (2002) provides a detailed analysis of the aluminium smelting industry in Australia, and internationally. He concludes that there is strong evidence that the aluminium smelting industry receives cheaper electricity than similar large industrial customers, as a result of long-term supply contracts negotiated with State governments attempting to attract industry to their State. This 'represents a subsidy if the prices are below those that would be paid in a freely competitive market, where electricity suppliers charge prices that reflect long-run marginal costs' (Turton 2002, p.11).

After reviewing the available evidence, Turton concludes that the annual subsidy for electricity use at the six existing Australian aluminium smelters is at least $210 million, and is likely over $250 million. In addition to electricity price subsidies, Turton's estimate includes the impact of the 1994 sale of the Gladstone Power Station by the Queensland Government (to a consortium headed by Comalco, majority owner of the adjacent Boyne Island smelter) at below market price. Professor Ian Lowe reported to the Joint Standing Committee on Treaties Inquiry into the Kyoto Protocol that the price was between half and two-thirds of the net value of the power station (Joint Standing Committee on Treaties 2000, p.254). This sale meets the definition of a subsidy, as it allows Comalco to either supply electricity to the Boyne Island smelter at below market prices or achieve higher earnings on its investment (Turton 2002).

The $3 billion Aldoga Aluminium Smelter, under construction in Queensland, also appears to have been offered substantial subsidies and concessions of about $100 million by the Queensland Government, the bulk of which comprised heavily discounted electricity supplies (Sydney Morning Herald 2001). These subsidies are not included in Turton's (2002) estimate.

Subsidies for electricity use by aluminium smelters reduce the economic incentive to invest in energy efficiency and therefore keep electricity consumption higher than it would be in the absence of subsidies. Electricity for Australia's smelters is supplied by black coal generation (NSW and Queensland), brown coal generation (Victoria) and hydroelectric generation (Tasmania). Turton (2002) attributes $15 million of the $210 million subsidy to the Bell Bay smelter in Tasmania, which uses renewable energy. Consequently, the estimated subsidy for fossil fuel consumption is at least $195 million and more likely $232 million (assuming the Bell Bay subsidy rises proportionally to $18 million in Turton's higher estimate).

Given that they reduce the economic incentive for energy efficiency improvement, it is reasonable to conclude that these subsidies are GHG emission subsidies. Analysis by Turton (2002) indicates that they are also perverse subsidies, as their removal would provide an overall benefit to the Australian economy. However, as these subsidies are implemented through long-term electricity supply contracts, options to remove them in the short-term are limited.

6.5.2 State energy concessions

State governments provide various energy concessions and payment assistance schemes for particular household customer groups, including concession card holders (e.g. people in receipt of aged-pensions or unemployment benefits), people in country areas, financially disadvantaged groups and people using home life-support equipment (see Table 6.1 for a summary). The subsidies are delivered as a discount or rebate on energy bills; most apply to electricity use but some also apply to natural gas use. By reducing the total cost of energy to particular householder groups, they provide an incentive to those groups to use more electricity than they otherwise would. As shown in Table 6.1, the subsidies total at least $270 million per year.

State/Territory	Subsidy	Annual Value ($m)	Source
New South Wales	Life Support Rebates Scheme Pensioner Energy Rebates Scheme Energy Account Payments Assistance	2.5 79 9	NSW Treasury (2004)
Victoria	Energy concessions	90	Vic Treasury (2004)
Queensland	Electricity rebates for pensioners and life-support	45	Estimate, drawing on Queensland Government (2004b)
South Australia	SA Energy Concession	30	Estimate drawing on Government of South Australia (2004)
Western Australia	Seniors Air Conditioning Rebate State Government Energy Rebate	Not estimated	Insufficient information available to allow an estimate
Tasmania	Electricity Rebates	13	Tasmanian Government (2004)
Australian Capital Territory	Energy concession	1	ACT Government (2004)
Northern Territory	Pensioner concessions	<1	Estimate based on information on Power and Water Authority website
TOTAL ($M)		270	

Table 6.1: Estimate of state energy supply subsidies for pensioners, financially disadvantaged users and users in remote areas.

Given that 92 per cent of Australia's electricity is sourced from fossil fuels, I have allocated 92 per cent of each subsidy to fossil fuels and 8 per cent to renewable energy. This is conservative, as some of the subsidies also support natural gas use, so the total proportion supporting fossil fuels would be higher than 92 per cent. The total subsidy to fossil fuels is therefore about $248 million per year (92% of $270 million) and the subsidy to renewable energy is about $22 million per year.

The fossil fuel subsidies are GHG emission subsidies, as they encourage greater energy use and discourage energy efficiency improvement. However, these subsidies are not necessarily perverse, as they meet the social objective of assisting disadvantaged householders with the cost of essential services. However, a better environmental outcome (and possibly a better economic outcome) could be obtained by using some portion of the current subsidy funds to improve energy efficiency in the target households. Using the funds for installation of efficient showerheads, shading, blinds and insulation could potentially reduce GHG emissions while still meeting the social objective of reducing the total cost of electricity bills for the target groups.

6.5.3 Electricity pricing structures

Electricity pricing structures can create market distortions that impact on electricity consumption and GHG emissions. Most of these subsidies are cross-subsidies between different parts of the electricity network rather than publicly funded subsidies, so I have not attempted to estimate their magnitude. Instead, I provide a brief discussion of each below.

Transmission pricing

Existing electricity transmission pricing regimes in Australia penalise distributed generation (including many renewable energy sources) and cogeneration (Hamilton & Denniss 2001). According to a Senate Inquiry into global warming:

> Current arrangements, which restrict transmission charging to generators to shallow entry costs, while leaving the bulk of costs to be recovered from customers, provide a substantial subsidy to remote, usually coal-fired generation to the competitive disadvantage of more greenhouse friendly natural gas and renewable generation typically located closer to loads. Pursuit of demand management options is also acutely disadvantaged (ECITA Committee 2000, p.170).

I have not attempted to estimate the size of this subsidy. However, it clearly acts to distort the electricity market in favour of fossil fuels by failing to reward generators that locate close to loads and by masking price signals that could encourage remote users to switch to local, renewable alternatives (Hamilton, Denniss & Turton 2002).

End user pricing

The structure of end user pricing can affect electricity demand and incentives for utilities to engage in demand management. For example, when electricity usage charges are used to finance fixed costs, electricity authorities have an incentive to sell electricity and no incentive to engage in demand-side management. According to Pender (pers.comm., 2001), a better system would involve a higher access charge to cover fixed costs, and a lower average charge for usage, with the usage charge varying to reflect load, so that charges would be very high at times of peak load. Regulatory authorities have moved to increase fixed access charges for electricity in recent years, although the impacts of higher fixed charges on low-income households are of concern (Riedy et al 2004).

Pender's other suggestion – usage charges that vary with load – has received much attention in the Australian energy policy network. For example, IPART recommended trials of localised congestion pricing in NSW, as part of its Inquiry into the Role of Demand Management and Other Options in the Provision of Energy Services (IPART 2002b). Real-time pricing and congestion pricing may be difficult to implement due to apparent customer preferences for fixed tariffs, rather than uncertain variable tariffs (Riedy et al 2004). Improved end-user pricing, if viable, could provide better signals for electricity users to reduce their total consumption through energy conservation and energy efficiency. Better pricing structures could also encourage load-shifting behaviour, which can reduce peak demand and the need for network augmentation.

Cross subsidisation of particular consumers

Cross subsidisation of particular electricity consumers by other consumers also occurs in Australia, as reported by Gilchrist (1994). Pears (1998) gives the example of a rural area in NSW where there was an electricity supply cost of up to 21.22 cents per kWh and an average selling price of up to 14.53 cents per kWh. This led to an average annual subsidy of $412 per household on a particular feeder line, paid by electricity consumers in urban areas. In remote communities in Western Australia, the cost of electricity generation can be as much as $1 per kWh, but there is a uniform tariff of 11c per kWh (Ebert 2002).

The effect of cross subsidisation is to distort the electricity market so that customers do not experience the true cost of generating electricity to meet their needs. Usually, urban customers pay slightly more than the true cost of generation, and rural customers pay less. The likely result is that rural customers will use more electricity than they otherwise would, and urban customers may use less. In terms of total electricity consumption and GHG emissions, the net effect may be minimal. However, if rural customers paid the true cost of electricity generation, renewable forms of electricity generation with higher costs would be better able to compete with fossil fuel generation in those areas. Cross subsidisation would therefore seem to put renewable energy at a disadvantage, although it can be defended on the basis of equity and regional development objectives.

6.5.4 Subsidies for centralised generation

Large centralised electricity generation projects have the opportunity to receive certain taxation benefits that are not available to smaller distributed or embedded generation projects. For example, projects with a capital cost of more than $50 million that were approved by the Development Allowance Authority (up to 1996) were eligible to claim an immediate deduction of 10 per cent of the value of plant and equipment. The estimated cost of this tax expenditure in 2002-03 was $170 million (Australian Government 2004g). Centralised electricity generation projects are also more likely to gain Major Projects Facilitation (MPF) status from the Australian Government than diffuse sustainable energy projects. Projects with MPF status receive support services from Invest Australia[55] at below cost.

Subsidies of this sort creates a bias in favour of large-scale fossil fuel generation and against demand management and renewable energy options that tend to be more diffuse and smaller in scale. I have not attempted to estimate the annual value of this subsidy due to the variable nature of investment in power generation and the commercial sensitivity of the information required.

6.5.5 Network augmentation subsidies

Historically, Australian governments heavily subsidised the expansion of the electricity grid to meet goals of national and regional development. In many cases, there are cheaper alternatives to network expansion, such as local generation or demand management, that can provide the same level of service. Where governments continue to support network expansion, despite the availability of cheaper alternatives, a subsidy exists.

There have been several recent examples of such subsidies. TransGrid and Energy Australia elected to construct the MetroGrid electricity network augmentation project in Sydney despite the existence of cheaper demand management alternatives (TransGrid & Energy Australia 2000). Another example is TransGrid's proposed Wollar to Wellington electricity line, which has a $24-39 million economic disbenefit and is more expensive than demand management alternatives (TEC 2003). Due to the variable nature of network investment, I have not attempted to estimate the size of the annual network augmentation subsidy.

6.5.6 The Mandatory Renewable Energy Target

I discussed the MRET in Sections 3.8.2 and 5.2.1. The MRET legislation creates a legal liability on wholesale purchasers of electricity to proportionately contribute towards the generation of an additional 9,500 GWh of renewable energy per year by 2010. There is a non-indexed penalty for non-compliance of $40/MWh (or $57/MWh pre-tax). The MRET therefore distorts the electricity market in favour of renewable energy sources over fossil fuels. However, apart from the

[55] Invest Australia is an Australian Government agency established to promote inward investment.

administration costs for the scheme, the MRET is not funded from taxpayer revenue; it is funded by the wholesale purchasers of electricity, who have the choice of paying the $40/MWh penalty or adopting cheaper renewable energy options. Ultimately, the cost of the scheme is passed on to electricity customers in tariffs or retailers in purchasing requirements. I would argue that the MRET is an appropriate way of including some of the externalities of electricity generation in the price of electricity; it is not a taxpayer-funded subsidy.

The cost of the administration of MRET by the Office of the Renewable Energy Regulator in 2003-04 was $1.9 million (Kemp 2004). The MRET Review estimated that the price of the Renewable Energy Certificate that liable parties must surrender to meet their MRET commitments will be $37/MWh, in 2003 dollars, over 2010 to 2020. This is less than the pre-tax penalty for non-compliance. Thus, the total size of the annual customer and retailer payment to the renewable energy industry over 2010 to 2020 is about $350 million. As noted above, this is a customer and retailer funded subsidy, not a taxpayer-funded subsidy, so is not included in my public subsidy estimates.

6.5.7 Other renewable electricity support programs

The Environment Budget Statement (Kemp 2004) provides details of other renewable electricity support programs funded by the Australian Government in 2003-04. These include:

- $0.4 million for a wind farm on the Cocos Keeling Islands
- $4 million for the Photovoltaic Rebate Program
- $16.7 million for the Renewable Remote Power Generation Program
- $4.6 million for the Renewable Energy Commercialisation Programme (half of the total support – the remainder is included in Section 6.6.10)
- $1.9 million for the Renewable Energy Equity Fund (half of the total support – the remainder is included in Section 6.6.10).

6.5.8 Magnitude of electricity subsidies

Table 6.2 summarises estimates of the magnitude of public electricity subsidies discussed in the sections above. Only three public subsidies were suitable for estimation; others either acted as cross-subsidies or could not be estimated due to their variability and/or commercial confidentiality.

Subsidy or Incentive	Annual FF Support ($m)	Annual RE Support ($m)	Subsidy Category	
			GHG Emission?	Perverse?
Subsidised supply of electricity to aluminium smelters	195-232	15-18	Yes	Yes
State electricity supply subsidies for low-income households	248	22	Yes	No
Mandatory Renewable Energy Target (administration)	-	1.9	No	No
Other renewable electricity support programs	-	27.6	No	No
CATEGORY TOTALS ($m)	**443-480**	**67-70**	**443-480**	**195-232**

Table 6.2: Summary and categorisation of electricity subsidies.

6.6 Other stationary energy subsidies

In this section, I consider subsidies in the stationary energy sector, excluding those already discussed for the electricity sector. These subsidies support actors involved in exploration, mining, processing, distribution and direct consumption of fossil fuels or renewable energy. Where these subsidies support production, they reduce the cost of producing energy, and therefore allow producers to either charge less for energy, or derive increased investment returns from their activities. Where these subsidies support consumption, they reduce the cost of consuming energy, and will therefore tend to increase consumption above the unsubsidised level. Both production and consumption subsidies tend to increase the amount of energy consumed above benchmark levels.

NIEIR (1996) estimated that subsidies to renewable energy and energy efficiency in Australia amounted to $43.1 million, or about 2 per cent of the total energy subsidies of almost $2 billion. However, with the implementation of several programs to support renewable energy since the NIEIR report was released, it is likely that this proportion has changed significantly. Table 6.6, in Section 6.6.11, summarises the magnitude and categorisation of the other stationary energy subsidies that I have considered in this research.

6.6.1 Greenhouse Gas Abatement Program

The major competitive funding mechanism under Australia's National Greenhouse Strategy is the Greenhouse Gas Abatement Program (GGAP). GGAP provides funding of $400 million for projects that will provide quantifiable additional abatement of greenhouse gas emissions in Australia. The program guidelines state that funds are allocated on merit to projects that provide cost-effective, large-scale greenhouse gas abatement. Funds are due to be fully allocated by 2005 and fully paid by 2013.

Table 6.3 summarises funding allocations made during Round 1 and 2 of GGAP, according to the industry and project supported. Some of the funding directly subsidises energy producers or consumers. The coal industry received a total of $16.1 million for improving thermal efficiency at a coal-fired power station and pre-drying brown coal to reduce GHG emissions. This is clearly a fossil fuel subsidy, but is not a GHG emission subsidy, as it will reduce GHG emissions from the beneficiary power stations. Similarly, $43.5 million was allocated to capture and use coalmine waste gas. Again, this is a fossil fuel subsidy but not a GHG emission subsidy, as the money is being used to capture and use methane that would otherwise be directly emitted to the atmosphere. The arguments in Section 6.4 about the appropriateness of continued government support for fossil fuel industries are, of course, relevant here.

Industry	Projects	Funding ($m)
Coal	Improve thermal efficiency at a coal-fired power station	5
	Pre-drying of brown coal through Mechanical Thermal Expression	11.1
	Sub-total	*16.1*
Mine waste gas	Capture and use of coalmine waste gas (methane) to generate electricity	43.5
Aluminium	Increase energy efficiency of an alumina refining plant	11
	Replace oil with natural gas at an alumina refinery	7
	Sub-total	*18*
Cogeneration	Establishment of natural gas fired cogeneration (combined heat and power) plants	26
Ethanol	Production of ethanol from sugar mill byproducts	7.4
	Replacement of petrol with an ethanol/petrol blend	8.8
	Sub-total	*16.2*
Transport	Program to reduce car reliance	6.5
Hydrochlorofluorocarbon (HCFC)	Training program for HCFC recovery	3.6
Total		**129.9**

Table 6.3: Allocation of funding in Rounds 1 and 2 of GGAP showing industry beneficiary.

The aluminium industry received $11 million to assist with energy efficiency improvements and $7 million to replace oil with natural gas at an alumina refinery. The latter payment is a fossil fuel consumer subsidy, as it reduces the cost to the alumina refinery of consuming natural gas. The cogeneration industry received $26 million for establishment of gas-fired cogeneration plants. This funding is a direct expenditure subsidy to natural gas consumers. However, neither of these fossil fuel subsidies are GHG emission subsidies, as gas is being used to replace fuel sources with a higher emissions intensity than natural gas. The ethanol industry received $16.2 million. This is a subsidy for renewable energy production. Funding was also provided for a program to reduce car reliance by encouraging walking, cycling, public transport and ride sharing; this is a transport sector subsidy, considered in Section 6.7.7.

In total, $92.6 million of the total $129.9 million has been allocated to projects that at least partially support fossil fuel producers or consumers, although none of these subsidies are GHG emission subsidies. A further $27.2 million has been allocated to energy efficiency improvement and support for renewable energy (ethanol). While the fossil fuel subsidies delivered through GGAP should not necessarily be removed, the extent to which the Australian Government's flagship GHG abatement program supports fossil fuel industries over renewable energy industries needs to be highlighted. These subsidies are indicative of a strong focus on short-term GHG abatement and end-of-pipe solutions, rather than the deep long-term GHG reductions that renewable energy can deliver.

The allocated funding is paid gradually over time, so the annual subsidies are significantly lower than the figures above. The 2003-04 budget for GGAP was $12 million. Assuming the proportions of the annual budget supporting fossil fuels, energy efficiency and renewable energy are the same as the proportions of the total funds allocated, the annual subsidies are about $9 million, $1 million and $1.5 million respectively.

6.6.2 Non-recovery of public agency costs

Public agencies in Australia provide basic geological information, databases and other information and management services to fossil fuel exploration and production companies at nominal costs. The main public agencies involved in the provision of information and support to the fossil fuel industry are Geoscience Australia (formerly the Australian Geological Survey Organisation), the Department of Industry, Tourism and Resources and government energy departments in each Australian State and Territory. NIEIR (1996) concludes that non-recovery of agency costs incurred in supporting the fossil fuel industry is effectively a subsidy to the coal, oil and gas industries in Australia. However, I would argue that this practice only constitutes a subsidy if the service provided clearly benefits a particular group, and not others. Where this is the case, it may be appropriate to recover the full costs of the service from the beneficiaries. In other cases, support may be more generally available, and will not constitute a subsidy to fossil fuels.

Where subsidies are deemed to exist, they will reduce the costs incurred by fossil fuel production companies and act to increase the activity levels of fossil fuel production companies above what they would otherwise be. This, in turn, allows a lower price to be charged for fossil fuels and is therefore likely to increase GHG emissions above the unsubsidised level. Subsidies of this type can therefore be categorised as GHG emission subsidies. By spreading costs across taxpayers, rather than allocating them to the specific beneficiaries, these subsidies also reduce economic efficiency and therefore act as perverse subsidies. These subsidies would be an appropriate target for gradual removal, with increased revenue tied to development of alternative fuels.

There are, of course, also public agencies that support renewable energy and energy efficiency and do not fully recover the costs of this support. In these cases, a subsidy to renewable energy or energy efficiency exists. In the sections below, I identify public sector agencies and departments that provide effective subsidies to companies in the stationary energy sector and estimate the magnitude of those subsidies using budget statements and annual reports.

Geoscience Australia

The total appropriation for Geoscience Australia in the 2003-04 federal budget was $97 million (Australian Government 2004d). The Geoscience Work Program for 2003-04 lists 55 projects, of which twelve provide direct support for petroleum exploration (Geoscience Australia 2003). These projects include the provision of technical advice to the petroleum industry, as well as research and mapping aimed at better understanding petroleum resources. Assuming an equal budget allocation for each project, the total budget allocation to projects that support the petroleum industry is about $21 million. Some of the other projects may also provide support for fossil fuel exploration, however, they equally provide support for other mineral exploration and other purposes. These projects are appropriately funded out of general revenue, as is the case at present.

Department of Industry, Tourism and Resources

NIEIR (1996) estimated that the Department of Primary Industries and Energy (a predecessor to the DITR) provided advice and administration support worth $30 million to the energy sector in 1994-95. This figure does not include funding for R&D. Budget papers for 2003-04 indicate that DITR had a total appropriation from government of $963 million (Australian Government 2004d). The budget papers do not provide sufficient information to estimate how much of this budget supports fossil fuel producers and consumers. I have therefore used two alternative methods to converge on an estimate of the subsidy associated with DITR administrative support and advice for the fossil fuel industry.

The first method is to allocate a proportion of NIEIR's original subsidy estimate to fossil fuels and then update this to 2003-04 dollars. As 95 per cent of Australia's primary energy is derived from fossil fuels, it is reasonable to assume that 95 per cent of the DITR support went to fossil fuels. This gives a subsidy of $28.5 million per year in 1994-95 dollars, or about $36 million per year in 2003-04 dollars.

Another approach is to examine the organisational structure of DITR, assume that total budget funding is allocated evenly between functional units, and identify the units that specifically support fossil fuels. DITR is divided into divisions, each of which has a number of subordinate branches or groups. Based on the organisational chart for DITR as of 1 January 2003, the total funding of $963 million is split between 44 branches or groups. Three branches within the Resources Division and five branches within the Energy and Environment Division would routinely provide advice and support to fossil fuel producers and consumers. However, most of these branches provide general support to the energy industry and not just to the fossil fuel industry. Only the Offshore Resources Branch, the Resources Development Branch and the Minerals and Fuels Branch appear likely to provide targeted support to the fossil fuel industry. As these three branches also provide support to mineral industries and other fuels, I have assumed that half of the funding for these branches directly supports fossil fuels. Assuming equal allocation of funding across the 44 branches or groups, the subsidy to fossil fuel producers is $33 million in 2003-04.

The subsidy estimates resulting from the two different approaches agree quite closely. In the absence of better data, I have used the average of the two figures ($34.5 million) as the subsidy estimate. This subsidy includes a $2.8 million allocation to geological sequestration of CO_2 in 2003-04 (Kemp 2004).

State departments

Table 6.4 summarises the NIEIR (1996) estimates of unrecovered costs from State government energy departments. The figures have been updated to 2003-04 dollars. NIEIR did not attempt to estimate what proportion of these unrecovered costs was incurred in providing services to fossil fuel producers. The subsidy to fossil fuels would have been somewhat less than the estimates NIEIR provided. To estimate the portions of unrecovered state department costs that support fossil fuels and renewable energy, I have undertaken detailed analysis of energy department annual reports, budget papers and strategic plans. New subsidy estimates derived from this analysis are provided in Table 6.4. Where cost recovery was practised, I have removed recovered costs from the estimates.

The subsidy estimates include any direct subsidies to fossil fuels or renewable energy identified from the document review. The estimates also include a portion of department staff and operating expenses equal to the proportion of departmental programs that were judged to directly support fossil fuels or renewable energy. As it was often difficult to determine funding for specific programs that support fossil fuels or renewable energy, I generally assumed that all major programs within a department were funded equally and estimated the subsidy by applying the proportion of programs supporting fossil fuels or renewable energy to the total departmental appropriation from government. As a result, subsidy estimates listed in Table 6.4 are indicative only. Detailed state-level analysis would be required to improve these estimates.

State/Territory	Agencies	NIEIR Estimate[1] ($m)	Current FF Estimate[2] ($m)	Current RE Estimate[3] ($m)
New South Wales	Department of Energy, Utilities and Sustainability	38	8	4
	Department of Primary Industries		25	-
Victoria	Department of Infrastructure	38	7	-
	Department of Primary Industries		9	-
	Sustainable Energy Authority Victoria		-	8.5
Queensland	Department of Natural Resources and Mines	95	30	-
	Department of Energy		2.5	2.5
Western Australia	Office of Energy	19	5	3
	Department of Industry and Resources		13	-
South Australia	Department of Primary Industries and Resources	13	6.5	-
	Energy SA		6.5	2
Tasmania	Department of Infrastructure, Energy and Resources	6	3	0.5
Northern Territory	Department of Business, Industry and Resource Development	4	12.5	-
Australian Capital Territory	Department of Urban Services	Not listed	-	-
TOTAL		213	128	20.5

Notes:

1. Total unrecovered costs from NIEIR (1996). The proportion that supports fossil fuel production or consumption would be less than these figures.
2. These estimates include only those costs that were incurred in supporting fossil fuel production or consumption and are based on analysis of budget papers and annual reports.
3. These estimates include only those costs that were incurred in supporting renewable energy and are based on analysis of budget papers and annual reports.

Table 6.4: Estimates of State and Territory energy department costs not recovered in 2003-04.

6.6.3 Petroleum exploration tax concessions

Tax concessions for petroleum exploration subsidise increased levels of exploration and production and keep costs lower than they would otherwise be. This allows petroleum companies either to keep the price of petroleum fuels below the benchmark level or receive a greater return on their investment. Tax concessions for petroleum exploration comprise a GHG emission subsidy. The following special deductions (from company tax) are available for companies involved in petroleum exploration and development activities:

- Immediate deduction of petroleum exploration and prospecting expenditures
- Immediate deduction of operating costs
- Until 30 June 2001, capital expenditure on certain petroleum transport facilities can be deducted in equal instalments over ten years, after that date such expenditure will be deducted over the effective life of the asset
- Immediate deduction of capital and current environment protection expenditures (except for plant subject to depreciation) on pollution control or waste management
- A deduction for Environment Impact Statement capital costs over ten years or the life of the project, whichever is the lesser
- Immediate deduction of certain mine-site rehabilitation costs including expenditure associated with the removal of offshore platforms
- Deductions for exploration and allowable capital expenditure are deductible without limit, with any excess to contribute to a tax loss for the year (DITR 2002).

The tax expenditure associated with capital expenditure deductions for petroleum transport facilities is estimated at $20 million for 2003-04 (Australian Government 2004g). The tax expenditure associated with the concessions for pollution control, waste management and Environmental Impact Statements is estimated at $3 million for 2003-04 (Australian Government 2004g). The other tax concessions are recognised as tax expenditures in the TES, but estimates of their value are not available.

Earlier TESs give an indication of the possible value of tax expenditures associated with deductibility of mineral and petroleum exploration costs. The 1995-96 TES estimated that the deduction of capital expenditures associated with prospecting or exploration by general and petroleum miners would result in a tax expenditure of $370 million in 2000-01 (Department of the Treasury 1997). This is the last year in which the value of the tax expenditure is reported. Although there have been some changes in the rules for deductions, this figure should still provide a reasonable estimate of the tax expenditure. DITR staff have provided similar estimates of the tax expenditure (Bill Layer, pers.comm., September 2000). In 2003-04 dollars, the tax expenditure equates to $402 million.

In 2001-02, total mineral and petroleum exploration expenditure in Australia was $1.73 billion, comprising $787 million for minerals and $944 million for petroleum (ABS 2004d). Assuming the impact on company tax is split in the same proportion, and the figure above for the tax expenditure is accurate, additional company tax revenue of $219 million could be earned if petroleum exploration costs were not deductible. This is a rough estimate of the tax expenditure associated with the deductibility of petroleum exploration costs.

Adding the $23 million identified above gives a total tax expenditure associated with tax concessions for petroleum exploration of $242 million. However, it is not immediately clear whether this is a subsidy to fossil fuels, as it must be considered in the context of overall petroleum taxation and charging. As well as the normal taxation arrangements applying to all companies, petroleum production projects are subject to a Petroleum Resource Rent Tax (PRRT). The PRRT is applied at a rate of 40 per cent of a project's net income, as a means of providing the 'Australian community with a fair and reasonable return from the development of non-renewable petroleum resources' (DISR 2000b, p.23). The PRRT collected $1.165 billion in revenue in 2003-04 (Australian Government 2004a). The states also impose resource taxes on fossil fuels, so it is clear that petroleum production companies are being taxed by a significantly larger amount than they are subsidised.

If resource taxes are not included in the taxation benchmark, then petroleum exploration and production companies experience a large excess tax burden, or negative subsidy, compared to other companies. The deductibility of petroleum exploration expenses from company tax would then be a reasonable way to relieve this excessive tax burden. On the other hand, the rationale for the PRRT and other resource taxes is the allocation of a fair share of the profit associated with development of a public non-renewable resource to the public. On this basis, resource taxation is something quite different to company taxation and can justifiably be included in the taxation benchmark, as part of the design of the taxation system. Indeed, this is the approach taken in the TES (Australian Government 2004g). According to the subsidy definitions discussed in Section 6.3, the deductions available to petroleum exploration companies are tax expenditures, and therefore constitute a subsidy to fossil fuel producers.

Although this subsidy acts as a GHG emission subsidy by keeping oil prices lower than they would otherwise be, it is not necessarily a perverse subsidy. The subsidy acts to encourage oil exploration, which remains vital to Australia's economic performance. Until petroleum alternatives are developed, failure to locate and develop domestic petroleum resources will impact strongly on Australia's balance of payments and indeed on social equity for low-income households that have little alternative but to pay higher fuel prices. On this basis, encouraging petroleum exploration can be justified as a public good. Removal of the subsidy without ensuring that appropriate alternatives exist would likely bring more economic harm than good. Gradual reduction of the subsidy and transfer of the funds to development of oil alternatives may be the best policy approach.

6.6.4 Research and development

In 1994, Australian governments provided $180 million for energy R&D, of which only $27 million (15 per cent of the total) funded renewable energy and energy efficiency applications (NIEIR 1996). These figures include not only direct expenditure on energy R&D but also the value of research-related tax deductions in 1994. Expenditure by private companies on R&D can be claimed as a deduction against company tax at a concessional rate of 125% of expenditure.

While Australian governments have increased funding for renewable energy R&D in recent years, it appears that fossil fuel R&D continues to receive the major proportion of government funding support. To check whether the situation has changed significantly since NIEIR released its report in 1996, I have reviewed current funding for the Australian CRC program and the CSIRO. The subsidy estimates developed in this section cover all stationary energy use, including electricity generation.

CRC funding

CRCs bring together researchers from universities, government and the private sector to research specified topics over a period of years. CRCs involved in R&D that wholly or partially benefits stationary energy industries are listed in Table 6.5, along with the value of their public funding in 2003-04. Notably, none of the CRCs supports renewable energy. Funding for the Australian CRC for Renewable Energy ceased on 30 June 2003 and no CRC focused on renewable energy has been funded since that time. As shown in Table 6.5, three CRCs with total government funding of $7.2 million per year were involved in research and development that supported fossil fuels in 2003-04.

CRC	Government Funding 2003-04 ($m)
Coal in Sustainable Development	2.1
Greenhouse Gas Technologies	3.1
Clean Power from Lignite	2.0
TOTAL	7.2

Table 6.5: CRCs involved in research and development that wholly or partially benefits the fossil fuel industry in 2003-04

CSIRO funding

Another example of the imbalance in R&D funding is evident in Australian Government funding allocated to the CSIRO, Australia's flagship research organisation, in 2003-04. The Australian Government allocated $569 million to the CSIRO in 2003-04, including $75 million for sustainable minerals and energy (Australian Government 2004c). The allocation for sustainable minerals and energy is divided between Energy Technology, Exploration and Mining, Minerals and Petroleum Resources divisions and the Energy Transformed Flagship research program. I have reviewed CSIRO's Annual Report (CSIRO 2003a), Strategic Plan (CSIRO 2003b) and website (CSIRO 2004) to develop estimates of the proportion of the sustainable minerals and energy funding that directly supports fossil fuels and renewable energy. Based on this analysis, government R&D support delivered through the CSIRO amounts to about $21.5 million per year for fossil fuels and $5.7 million per year for renewable energy.

Total R&D subsidies

Total funding for energy resources and energy supply R&D in Australia in 2002-03[56] was $493.2 million (ABS 2004e). Based on ABS figures, governments provided about $143 million of this R&D funding in 2002-03 (ABS 2004e, 2004f, 2004g, 2004h), or $146 million in 2003-04 dollars. Additional government research funding is provided through tax concessions for business R&D. In 2003-04, these tax expenditures amounted to $360 million in total (Australian Government 2004g). In 2002-03, about 5.6 per cent of total business R&D expenditure was allocated to the energy resources and energy supply sectors (ABS 2004f). Assuming the tax concessions were taken up by businesses in the same proportion, the tax expenditure for stationary energy R&D would amount to an additional $20 million. This gives a total of $166 million in government R&D funding for the stationary energy sector.

Assuming the split of R&D funding between fossil fuels and renewable energy in CSIRO funding is typical, the fossil fuel subsidy from R&D funding would be about $131 million and the renewable energy subsidy would be about $35 million. Given that the other major Australian research program considered above – the CRC program – allocates no funding to renewable energy, this may be an overestimate of renewable energy R&D funding. Taking the average of the proportion of funding allocated to fossil fuels and renewable energy by the CRC program and CSIRO, the respective subsidies would be $149 million and $17 million.

The fossil fuel subsidy estimated here is not necessarily a GHG emission subsidy. Many of the R&D programs supporting fossil fuels are aimed directly at reducing the environmental impact of fossil fuel production and consumption, while others will improve efficiency of fossil fuel use and will indirectly reduce GHG emissions. While there are strong arguments for allocating a greater proportion of total funding to renewable energy and energy efficiency, R&D to reduce the greenhouse signature of fossil fuel use remains vital in the short- to medium-term.

[56] The most recent available data is for 2002-03.

6.6.5 Direct subsidies to fossil fuel development projects

Stuart Oil Shale Project

The Stuart Oil Shale Project in Queensland received a series of direct subsidies from the Australian and Queensland Governments. The project aimed to process a major oil shale deposit located near Gladstone to produce medium shale oil and naptha in approximately equal fractions. The project was granted a rebate on excise tax for up to 600,000 barrels per year of gasoline produced from oil shale until 2005 (Greenpeace Australia 2001; SPP/CPM 2001). At an excise rate of 37.5 cents per litre, this exemption could potentially be worth $35.8 million per year. Actual production in 2003 was 422,280 barrels before the proponents of the project went into receivership in late 2003. The subsidy would therefore have been worth $25.2 million in 2003. Shale oil from the project is also exempt from Queensland Government royalties, which normally amount to 10% of the wellhead value. At an average sale price of $52 per barrel in 2002 (SPP/CPM 2001), and 2003 sales of 422,280 barrels, this exemption is worth another $2.2 million. The future of the project, and consequently these subsidies, is currently uncertain.

Stage 1 of the Stuart Project received a grant of $7 million from the Commonwealth Government for research and development (SPP/CPM 2001). The previous estimate of total annual R&D support for fossil fuel projects includes grants like this one, so it is not added to the subsidy total to avoid double counting. It has also been reported that the Queensland Government provided $11 million to construct a dedicated bulk liquid tanker berth for the project (Queensland Greens 2001). As a one-off payment, this subsidy is also excluded from the annual subsidy estimates listed in Table 6.6.

Collie coal-fired power station

The ready availability of coal from state mines for use in generating electricity may also have contributed to the construction of coal-fired power stations when other options would have been more economic. In Western Australia, the State Government supported the construction of the Collie coal-fired power station although the official (Harman) committee recommended that a gas-fired power station would have been cheaper. The total additional discounted (eight per cent discount rate) cost in 1990 dollars is estimated at $170 million and would be even greater if additional costs of greenhouse gas emissions were considered (OECD 1997). Again, this one-off subsidy is excluded from the estimates in Table 6.6.

Tasmanian gas reticulation

Blakers (2003) reports that the Tasmanian Government has provided a subsidy of $8 million to PowerCo for gas reticulation to industry, and is expected to provide a further subsidy of more than $20 million for gas reticulation to domestic customers. As one-off subsidies, these are not included in the subsidy estimates in Table 6.6.

6.6.6 Energy Grants Credits Scheme: off-road component

The Australian Government's Energy Grants Credits Scheme (EGCS) provides grants for fuels used in specified on-road and off-road activities. I will consider the off-road component of the scheme here and the on-road component in Section 6.7.13. The off-road component of the EGCS comprises a rebate for customs or excise duty paid on diesel or 'like fuels' (e.g. fuel oil) used in specified off-road activities, such as mining, agriculture, rail transport and electricity generation. Excise duty is collected for fuels produced in Australia and customs duty is collected for fuels imported into Australia. The customs and excise duty rate is 38 cents per litre for ultra low sulphur diesel and 40 cents per litre for other diesel. In 2003-04, the budget for the off-road component of the EGCS was $2.35 billion (Australian Government 2003a).

Some members of the Australian climate policy network, particularly members of the greenhouse action discourse coalition, have argued that the off-road component of the EGCS provides a subsidy for diesel fuel consumption. However, according to the subsidy definitions applied in this chapter, this is not the case. The rationale for the off-road component of the EGCS is that off-road use of diesel fuel should be exempt from excise as the revenue collected through excise is used to fund roads, which are not used by off-road users. In addition, competing end-use energy sources such as natural gas and electricity are not subject to excise duty, so the rebate is a way of avoiding subsidisation of these other sources (NIEIR 1996). NIEIR concluded, and I concur, that the off-road component of the EGCS (then known as the Diesel Fuel Rebate Scheme) should not be seen as a financial subsidy (NIEIR 1996).

This does not mean that the price of diesel used for off-road applications adequately reflects environmental and social externalities associated with its use. However, this is a separate matter that is better addressed by other programs. A typical program of this type is the Renewable Remote Power Generation Program, coordinated by the AGO, which aims to reduce the use of diesel for remote electricity generation, so that a portion of the EGCS will eventually become obsolete.

6.6.7 Concessional rate of excise for fuel oil, heating oil and kerosene

Fuel oil, heating oil and kerosene not used in internal combustion engines is subject to a lower rate of excise than the benchmark rate for unleaded petrol and ultra low sulphur diesel, resulting in a tax expenditure of $250 million in 2003-04 (Australian Government 2004g). This is a subsidy for the use of fossil fuels in heating, lighting and other applications. It encourages greater consumption of these fuels and discourages alternatives such as improving insulation or purchasing a modern efficient heater. This subsidy is therefore a GHG emission subsidy.

It is more difficult to judge whether this subsidy is perverse. The subsidy has some social objectives, such as ensuring that low-income households with old heating equipment can afford to keep warm in winter. However, these same social objectives could be achieved at lower cost by making the money available to low-income households to upgrade old heating systems or improve insulation. I have therefore classified this subsidy as perverse, while recognising that subsidy removal must be sensitive to social equity issues.

6.6.8 Exemption from excise for alternative fuels

Alternative fuels, including LPG and compressed natural gas (CNG), are currently exempt from excise duty. The 2003 TES defines the rate of excise on unleaded petrol and ultra low sulphur diesel as the benchmark rate of excise (Australian Government 2004g). As a result, the exemption of these alternative fuels is listed as tax expenditure, with a value of $830 million in 2003-04.

The tax expenditure is based on estimates and projections of fuel use published by ABARE. It is calculated on an equivalent unit of energy basis, which adjusts for the different energy content of alternative fuels compared to the energy content of unleaded petrol (Australian Government 2004g). According to ABARE statistics, consumption of CNG in 2002-03 was negligible compared to LPG consumption, with no significant change expected for 2003-04 (Akmal et al 2004). Therefore, essentially the entire tax expenditure of $830 million is a subsidy for consumption of LPG.

Australia consumed about 104 PJ of LPG in 2002-03; 37 per cent of the total consumption was in the stationary energy sector and 63 per cent was in the transport sector (Akmal et al 2004). I have therefore divided the subsidy between the stationary energy and transport sectors in the same proportions, giving subsidies of $303 million and $527 million respectively.

In the stationary energy sector, the subsidy to LPG encourages consumption above the benchmark level. This consumption will be either additional consumption, or substitution for other fuels, such as wood, natural gas, petroleum products and electricity. Where LPG replaces electricity or petroleum products it will tend to reduce overall emissions; where it replaces wood or natural gas, or adds to total consumption, it will tend to increase overall emissions. Without detailed analysis, it is not possible to determine whether the net effect of these substitutions is to increase or decrease GHG emissions.

6.6.9 Take or pay contracts

Australian governments have supported several major fossil fuel development projects in Australia through the negotiation of **take or pay** contracts. These contracts shift a proportion of the risk involved with major development projects from the developer to the customer by obligating the customer to pay for a specified quantity of the energy, whether or not that quantity is actually consumed. Where the customer is a government, this guarantee of purchase constitutes a subsidy.

In Western Australia, the then State Electricity Commission entered into a take or pay contract to buy gas from Woodside Petroleum to assist the development of the North West Shelf natural gas reserves. The Victorian Government was previously involved in a take or pay contract with Edison Mission Energy to take electricity from the Loy Yang B power station, in addition to take or pay contracts to purchase large volumes of natural gas. More recently, the Tasmanian Government (through Hydro Tasmania) has underwritten the development of the Basslink project by entering into a contract that includes the payment of an annual facility fee to the developer (Basslink PL) for 25 years (Blakers 2003). The facility fee is estimated at $60-70 million per year, although it may now be approaching $100 million (Blakers 2003). The Tasmanian Government has also underwritten the Duke gas pipeline through a take or pay contract (Blakers 2003).

These various contracts lower the cost of large energy development projects by reducing the risk faced by the developer. As take or pay contracts are invariably commercial in confidence it is not possible to reliably estimate the size of the subsidy associated with existing contracts. In the case of Basslink, it is also unclear whether the subsidy will act as a GHG emission subsidy. The Basslink project links the Tasmanian electricity grid and its predominantly renewable energy sources to the NEM. This could facilitate greater development and use of Tasmania's renewable energy resources by providing access to a much larger market. Alternatively, it could result in significant importation to Tasmania of lower cost electricity generated using fossil fuel, thereby reducing use of renewable energy. As it is unclear whether the Basslink subsidies will support fossil fuels or renewable energy (most likely they will support both), I have not included this subsidy in the estimates in Table 6.6.

6.6.10 *Renewable energy support programs*

The Environment Budget Statement (Kemp 2004) provides details of other renewable energy support programs funded by the Australian Government in 2003-04. These include:

- $4.5 million for the Renewable Energy Commercialisation Programme (half of the total support – the remainder is included in Section 6.5.7)
- $1.9 million for the Renewable Energy Equity Fund (half of the total support – the remainder is included in Section 6.5.7).

6.6.11 *Magnitude of other stationary energy subsidies*

Table 6.6 summarises other stationary energy subsidies and identifies those fossil fuel subsidies that are GHG emission subsidies and perverse subsidies.

Subsidy or Incentive	Annual FF Support ($m)	Annual RE Support ($m)	Subsidy Category	
			GHG Emission?	Perverse?
Greenhouse Gas Abatement Program (GGAP)	9	1.5	No	No
Geoscience Australia – non-recovery of costs	21	-	Yes	Yes
DITR – non-recovery of costs	34.5	-	Yes	Yes
State energy departments / agencies – non-recovery of costs	128	20.5	Yes	Yes
Special company tax deductions for petroleum exploration	242	-	Yes	No
Research and development	131-149	17-35	No	No
Stuart Oil Shale excise and royalty exemption	0-38	-	Yes	Yes
Concessional rate of excise for fuel oil, heating oil and kerosene	250	-	Yes	Yes
Excise exemption for alternative fuels	303	-	Uncertain	Uncertain
Other renewable energy support programs	-	6.4	No	No
CATEGORY TOTALS ($m)	**1,119-1,175**	**45-80**	**676-714**	**434-472**

Table 6.6: Summary and categorisation of other stationary energy subsidies.

6.7 Transport subsidies

In this section, my focus is primarily on subsidies for road transport users. I take a cost recovery perspective to estimate the magnitude of the road user subsidy in Australia, arguing that road users should pay the full cost of that use. I do consider subsidies for other transportation modes in passing, where there are evident fossil fuel or renewable energy subsidies, but do not attempt a comprehensive estimate of these subsidies, as my research focus in this thesis is predominantly on the stationary energy sector and the cost differential between fossil fuels and renewable energy.

Subsidies for road transport users do not automatically encourage production or consumption of fossil fuels. Rather, a subsidy that reduces the cost to motorists of road transport will encourage increased use of the road network (in terms of total vehicle kilometres travelled). Theoretically, vehicles using the road network could use any one of a variety of fuels, fossil or renewable. If all vehicles used renewable fuel sources, then subsidies for road transport users would not encourage increased use of fossil fuels and would not raise GHG emissions above the benchmark level.

In practice, Australian road vehicles are almost entirely reliant on fossil fuels. In 2001-02, the only fuels making a significant contribution to total road transport energy use were LPG (6.5 per cent of the total) and other petroleum products (93.5 per cent of the total); use of renewable fuels was negligible (Akmal et al 2004). Even so, this does not automatically mean that any subsidy for road transport use is also a direct subsidy to fossil fuel use. Some of the road transport subsidy may improve access to the road network for users that would otherwise be unable to use the system. While this could be expected to increase total fossil fuel consumption, the effects of congestion due to the greater number of road users could actually keep fossil fuel consumption stable, or even decrease it. The larger number of users would each travel less to avoid congestion. Further, subsidies for R&D may improve road transport efficiency, creating a net reduction in GHG emissions. I will consider whether particular subsidies are GHG emission subsidies in the sections below.

In Sections 6.7.1 to 6.7.6, I report on an analysis of the structure of the road taxation and charging system, undertaken to identify the magnitude of the road user deficit – the difference between the cost of providing and maintaining the road network and the revenue obtained from road users. In Sections 6.7.7 to 6.7.19, I review additional road transport user subsidies not included in my estimate of the road user deficit. Finally, in Section 6.7.20, I summarise the magnitude of transport subsidies considered in this research.

6.7.1 Is the road user deficit a subsidy?

As noted above, the road user deficit is the difference between the total cost of providing and maintaining the road network and the revenue collected from road users. The largest source of road-related revenue is the Federal excise on petroleum products and crude oil, which raised $13.5 billion in 2003-04 (Australian Government 2004a). The excise adds 38 to 40 cents to the cost of each litre of fuel used by road users.

Some policy makers argue that fuel excise is a general revenue-raising measure that should not be linked to the level of road funding. For example, this was the conclusion of an independent Fuel Tax Inquiry established by the Australian Government in 2002 (Fuel Taxation Inquiry Committee 2002). Other authors adopt a user-pays perspective, arguing that fuel excise revenue should be directly allocated to road funding (e.g. Pender 1999). Pender (1999) surveys the various government taxes on vehicle ownership and use and distinguishes between economic charges and taxes. He argues that revenue collected by governments that accounts for road network costs and social costs is effectively a charge; any revenue collected above that amount is a tax. Pender argues, and I agree, that the Federal fuel excise has the economic characteristics of a road user charge, whatever its stated aims. That is, from an economic perspective, road users experience fuel excise as a charge for their road use rather than a contribution to general taxation revenue.

Pender also distinguishes between revenue from access charges and revenue from usage charges. Access charges in Australia include import tariff revenue on vehicles, Goods and Services Tax (GST) on purchase of vehicles, state registration fees and stamp duty. Usage charges include federal fuel excise and GST on fuel and other consumables (tyres, oil, parts etc).

According to the subsidy definitions in Section 6.3, road users experience a subsidy if total government revenue from road access and usage charges is less than the total public cost of establishing and maintaining the road network. That is, road users experience a subsidy if road charges are not set high enough to cover costs (or the road user deficit is positive). As total distance travelled on roads is sensitive to user charges (Pender 1999), any subsidy will increase the total distance travelled above the benchmark level and hence increase GHG emissions. If total revenue exceeds the total costs, then there is an excess tax on road use and no subsidy exists.

This definition of the road user deficit as a subsidy is consistent with neo-classical economic theory and the objective of competitive neutrality between transport modes in a market system. Alternatively, the road network may be treated as a public good, in which case there are arguments for using general revenue to partially fund road transport. However, this argument is difficult to sustain in light of the huge negative externalities associated with road transport, including accident costs, congestion, air and noise pollution and GHG emissions. Hamilton et al (2002) estimate these costs amount to $30 billion per annum in Australia. I will examine the costs of the road network in more detail in the next section.

6.7.2 Market costs and externalities

NIEIR (1996) and Pender (1999) identify the following costs associated with establishment, operation and maintenance of the road network:

- The capital cost of road network infrastructure provision
- Road network maintenance costs
- Depreciation of road network infrastructure
- Health and ecological costs of local air pollution associated with vehicles
- Costs of climate change associated with greenhouse gas emissions from the road network
- Loss of aesthetic values
- Disruption of landscape and wildlife
- The cost of accidents (both direct hospital and medical costs and the cost of lost productivity)
- Costs of increased noise
- Time costs of congestion.

Theoretically, in a free market system, charges for road access and use should cover all of these costs, while also ensuring a normal rate of return on the road network assets (land and infrastructure). In practice, some of these costs are very difficult to estimate in monetary terms and have traditionally been classed as externalities.

Previous estimates of the size of the road user deficit in Australia vary significantly due to differing choices of which costs to include and varying methods used to estimate the value of these costs (e.g. Diesendorf 2002; Hamilton, Denniss & Turton 2002; Industry Commission 1994; Laird et al 2001; NIEIR 1996; Pender 1999). Among authors of previous estimates, there is little dispute that road users should pay the capital cost of road infrastructure expansion and the recurring cost of road maintenance. Further, the road network and the land on which it is sited is a capital asset that should be required to earn a normal rate of return on investment (NIEIR 1996; Pender 1999). Most of the authors accept that road users should be charged at a sufficient rate to provide this return on investment.

There is less agreement on which environmental and social costs should be included. Most estimates treat the cost of climate change induced by greenhouse gas emissions from vehicles as an externality. Given the problems with estimates of the cost of climate change, discussed in Section 3.7.2, this exclusion is understandable. Most estimates also exclude the health costs associated with vehicle emissions. As I am focusing on financial subsidies, I will also exclude climate change and health costs from my analysis.

However, some estimates include the cost of noise pollution, the time costs of traffic congestion and the property damage and medical/hospital costs of two-car accidents. As these costs can be estimated (with difficulty), it may be reasonable to include them in the total cost of the road network. In the next section, I will review previous estimates of road user subsidies in Australia with a particular focus on their treatment of the various costs associated with the road network.

6.7.3 Previous estimates of the road user deficit

Table 6.7 summarises previous estimates of the road user deficit in Australia and identifies some of the reasons for variation between the different estimates. Clearly, as noted above, there is substantial variation between the different estimates. While the subsidy estimate by Laird et al (2001) is arguably the most comprehensive in terms of the range of external costs included and the geographical coverage, Pender's (1999) estimation method is the most sound given the discussion of benchmarks in Section 6.3.2.

Pender argues that identifying the magnitude of the subsidy to road users is not as simple as subtracting total road user revenue from an estimate of the total cost of the road network. Instead, it is necessary to compare the treatment of road users against an appropriate benchmark, defined as 'the tax treatment of private activity plus an allowance for the social costs generated by vehicle use' (Pender 1999, p.31). Pender develops accounts for a hypothetical privatised road authority to facilitate comparison with the benchmark. His approach is consistent with the subsidy definitions in Section 6.3. Pender used data for 1994-95 and found a small excess tax on road users. There have been substantial changes to road taxation since that time. Therefore, in the next two sections, I apply Pender's method to develop an updated estimate of the magnitude of the road user subsidy in Australia.

Source	Annual Subsidy ($m)	Comments
Diesendorf (2002)	4,800 to 5,900	The estimate is for 1996, for Sydney only. It includes costs of land used for private parking, infrastructure, rolling stock, operations and maintenance. Heavy vehicles determined the construction and maintenance costs of major roads and cars determined the costs of local roads.
Submissions to Industry Commission (1994) report on urban transport	-800 to 10,000	Various estimates were provided in submissions, with varying choice of costs to include and varying methods employed to estimate particular costs, especially congestion costs.
Laird et al (2001)	8,000 to 19,000	The date of the estimate is unclear, although it is likely for 2001. It includes road system costs, road crash costs (partially recovered through insurance premiums), other health impacts and impact of FBT arrangements. The high figure includes road congestion costs; the low figure excludes these costs. The road user deficit is calculated as total costs minus total revenue.
NIEIR (1996)	1,200	The estimate is for 1994 in 1994 dollars. It includes the cost of damage to the road network that requires maintenance and capital return on infrastructure and land under infrastructure. It does not include costs of congestion or noise. It is unclear whether the maintenance cost included an allowance for network augmentation.
Pender (1999)	-100	The estimate is for 1994-95 in 1994-95 dollars. It includes road maintenance costs, the cost of capacity expansion and a return on investment for road infrastructure. Pender uses hypothetical road authority accounts to facilitate comparison of road user charges with an appropriate taxation benchmark.

Notes:

1. A negative number in this column constitutes an excess tax; a positive number constitutes a subsidy.

Table 6.7: Summary of previous estimates of the road user deficit in Australia.

6.7.4 Road user revenue

It is a relatively straightforward matter to estimate the revenue from road users, as most of the data is available in budget papers and regular reports. I will discuss the different revenue components below; they are summarised in Table 6.8.

Tariff revenue

In 2003-04, the tariff rate for most imported passenger motor vehicles (PMVs) was 15% of the customs value. The tariff rate for imported four-wheel drive vehicles (4WDs), light commercial vehicles (LCVs) and most other road vehicles was 5% of the customs value. Pender estimated that tariff revenue amounted to $1 billion in 1994-95 (Pender 1999). However, tariff rates for PMVs have fallen by 5 per cent since 1994-95 and the customs value of imported vehicles has changed. This means that tariff revenue needs to be recalculated.

The total customs value of vehicles imported into Australia in 2003-04 was $11.2 billion (ABS 2004c). In 1999, which is the most recent year for which I have been able to locate data, the proportion of the total customs value attributable to PMVs (excluding 4WDs and LCVs) was 45 per cent and to 4WDs, LCVs and other vehicles was 55 per cent (DISR 2000a). Assuming the same value split between PMVs and other vehicles existed in 2003-04, total vehicle tariff revenue was about $1.06 billion. Actual tariff revenue may have been slightly lower, due to an increase in the market share of 4WDs compared to PMVs over 1999 to 2003-04. However, for the purposes of identifying the road user deficit, it is conservative to take the higher revenue assumption.

A conservative estimate of tariff revenue from road users is therefore about $1.06 billion. Road users experience the tariff as an increase in the price paid for imported cars above what they would pay if free trade in motor vehicles were permitted.

GST and Luxury Car Tax

In his calculation of total road user charges, Pender included an excess component of the Wholesale Sales Tax (WST), which was abolished when the GST was introduced in 2000. The excess WST component was calculated relative to a 10 per cent GST, chosen as the benchmark for fair consumption tax treatment. Pender's rationale was that the WST fell relatively heavily on road users compared to other taxpayers and that a broad-based GST would provide fairer tax treatment. The current 10 per cent GST is a broad-based consumption tax that meets Pender's criteria for a fair consumption tax benchmark and is included in the taxation benchmark in the TES (Australian Government 2004g). Under the current GST, motorists are taxed at the same rate as other taxpayers. The GST does not, therefore, constitute a road user charge.

Before the GST was introduced, a higher rate of WST applied to luxury cars. To preserve government revenue, a Luxury Car Tax (LCT) was introduced. In 2003-04, revenue from the LCT was $336 million (Australian Government 2004a). This constitutes an access charge for road users.

Motor vehicle registration revenue

Pender estimated registration fees, collected by State governments, at $2.2 billion ($1.8 billion for cars and $0.4 billion for trucks). Current figures for registration fees and stamp duty on motor vehicle registrations and transfers are available from the Commonwealth Grants Commission (Commonwealth Grants Commission 2004). For 2002-03, heavy vehicle registration fees and taxes were $552 million, other vehicle registration fees and taxes were $2.51 billion and stamp duty on motor vehicle registrations and transfers was $1.68 billion (Commonwealth Grants Commission 2004). Total state revenue from these sources was $4.74 billion in 2002-03, or $4.85 billion in 2003-04 dollars. Heavy vehicles can also choose to register under the Federal Interstate Registration

Scheme, which collected $42 million in registration charges in 2003-04 (Australian Government 2004e). The Commonwealth Grants Commission does not provide an estimate of licence fees; I have estimated licence fee revenue at $300 million in 2003-04 based on historical data in BTRE (2004).

Federal fuel excise

Pender estimated that the value of Australian Government fuel excise was $7.9 billion in 1994-95 and that the petrol products franchises, which applied in all States except Queensland, collected additional revenue of $1.4 billion. Since the time of Pender's estimate, the state petrol taxes have been abolished and all fuel excise is collected by the Australian Government. A portion of the excise is transferred to the states. Total Federal fuel excise collected from petroleum products in 2003-04 was $13.2 billion (Australian Government 2004a).

However, this figure includes excise collected from off-road users of diesel fuel, which is returned through the EGCS. Approximately $2.35 billion of the total excise revenue was returned through the off-road component of the EGCS in 2003-04 (Australian Government 2003a). As discussed in Section 6.6.6, the return of these funds is appropriate. However, to calculate the total revenue from road users, the value of the off-road component of the EGCS needs to be subtracted from the total fuel excise collected. Therefore, about $10.9 billion in net fuel excise was collected from road users in 2003-04.

An additional $492 million of Australian Government fuel excise is returned through the Queensland Fuel Subsidy Scheme, which aims to keep fuel prices in Queensland at the lower levels that existed before the Federal Government took over all petrol taxes (Queensland Government 2004a). When this figure is removed, net fuel excise collected from road users was about $10.4 billion in 2003-04.

Road tolls

Pender does not include an estimate of toll revenue. Public and private toll revenue in 2001-02, the most recent year for which data is available, was estimated at $603.4 million (BTRE 2004). In 2003-04 dollars, this is about $637 million. Allowing for the opening of new toll roads and toll increases, I have estimated toll revenue at about $700 million in 2003-04.

Parking fees

Parking fees collected by local governments are another source of revenue from road users. It is difficult to arrive at an estimate of the annual magnitude of these fees, as numerous councils across Australia hold the required data. The work by Diesendorf (2002), which considers the value of land used for parking, indicates that the fees charged for parking are very unlikely to compensate for the lost opportunity cost of the land provided for parking. I have excluded both parking fees and the value of land used for parking from this analysis, while noting that inclusion of these costs and benefits would tend to increase the magnitude of the road user deficit.

Summary of road user revenue

Table 6.8 summarises the estimates of revenue from road users in Australia for 2003-04. The total revenue was $17.7 billion.

Revenue Source	Value ($m 2003-04)
Vehicle import tariffs	1,060
Luxury car tax	336
Heavy vehicle registration fees and taxes	565
Other vehicle registration fees and taxes	2,570
Stamp duty on motor vehicle registrations and transfers	1,720
Federal Interstate Registration Scheme	42
Licence fees	300
Net fuel excise	10,380
Toll revenue	700
TOTAL	**17,673**

Table 6.8: Sources of revenue from road users in Australia, 2003-04.

6.7.5 Determining appropriate revenue

Pender's hypothetical privatised road authority is subject to regulation and must abide by the regulator's decisions. The regulator makes decisions regarding road network improvement and capacity expansion. The road authority incurs expenses associated with road maintenance and any capacity expansion directed by the regulator. As a private entity, it must also pay state land tax on the 'single dwelling residential use' value of land under roads in urban areas (Pender 1999). In addition, the road authority must pay the state a normal rate of return on the value of the land under roads and the written down value of road materials.

To cover these expenses, the road authority is allowed to establish a charge for access to the road network and a charge related to the distance travelled on the road network. Pender also argues for the establishment of congestion, accident and noise levies, set by the regulator, as a component of the road authority's revenue. His intention is not that these levies will cover the full costs of congestion, accidents and noise, which are currently treated as externalities. Rather, they provide a way of structuring the total road user revenue so that it begins to reflect some of the social costs of road use. The structure of road user charges is certainly important, but it is the total required revenue that is of most interest for estimating the road user deficit. In the sections below, I will estimate the magnitude of the hypothetical road authority's expenses so that the appropriate level of revenue can be determined and compared to the actual revenue from Section 6.7.4.

Road maintenance and capacity expansion costs

The National Transport Commission (NTC) provides the most recent information on total government expenditure on road maintenance and road network expansion. In 2002-03, government spending on rural and urban arterial roads amounted to $4.356 billion (NTC 2004), or $4.459 billion in 2003-04 dollars. In 2001-02, government spending on rural and urban local roads was $3.714 billion (NTC 2004), or $3.919 billion in 2003-04. Therefore, total annual road spending, in 2003-04 dollars, is about $8.4 billion.

Land tax

Pender's hypothetical road authority must pay state land tax at 1.5% on the 'single dwelling residential use' value of land covered in tarmac in urban areas (Pender 1999). Land tax rates vary from state to state and with the value of the land. From my review of land tax rates across Australia, a land tax rate of 1.7 per cent (the rate that currently applies in NSW) is more representative of current land tax rates than Pender's assumption.

In 2001-02, the total value of residential land in Australia was $840.2 billion (Commonwealth Grants Commission 2003). The total number of private dwellings in Australia in 2001 was 7.4 million (ABS 2004b). Therefore, the average residential land value in Australia was about $113, 540 in 2001-02. It would be reasonable to assume that land values in urban areas will be higher than the Australian average. ABS data on the value of dwellings indicates that the median value of dwellings in capital cities is about 10 per cent higher than the Australian average (ABS 2004a). Assuming that land values are also 10 per cent higher gives an average urban residential land value of about $125,000 for 2001-02. This equates to about $132,000 in 2003-04 dollars.

In 1999, the total lane length of urban arterial roads was 36,712 km and of urban local roads was 169,482 (Austroads 2000a). This gives a total urban lane length of 206,194 km. These are the most recent available figures for road lane length. Assuming, after Pender, that average lane width is 3 metres, the total urban road area is about 0.62 billion square metres. Assuming, also after Pender, that the average urban lot size is 1,000 square metres, the area under the urban road network is equivalent to 618,582 urban residential properties. Applying the land value derived above and the assumed land tax rate of 1.7 per cent, total land tax payable by the hypothetical road authority is about $1.4 billion.

Normal rate of return

By valuing land allocated to the urban road network at its alternate use of single dwelling residential, Pender estimated the value of the urban road network at $88 billion and the rural road network at $63 billion. These figures include the written-down value of the tarmac and other materials in the road network. The road authority is required to pay the state a 5 per cent real pre-tax return on the value of the road network. Using the figures above, Pender's estimate of the size of this payment in 1994-95 was $7.6 billion (Pender 1999).

I have updated Pender's estimate of the value of land under the urban road network using the figures discussed above for calculation of land tax. The value of land under the urban road network comes to $81.65 billion in 2003-04 dollars. I have not been able to find more recent data to estimate the value of land under the rural road network; it is not possible to use the average residential land value developed above as much of the rural road network is located in non-residential areas. Therefore, I have simply updated Pender's estimate to 2003-04 dollars, giving a total value of land under the rural road network of $79 billion. In 2000, Austroads (2000b) estimated the 1997 written down value of road infrastructure (roads and bridges), excluding land value, as $59.106 billion. In 2003-04 dollars, this amounts to $71.4 billion. Thus, the total value of the road network, including the value of land under the network, is $232.05 billion. At a 5 per cent rate of return, the hypothetical road authority needs to achieve an annual return of $11.6 billion on its road assets.

Summary of hypothetical road authority expenditure

Table 6.9 summarises the components of the hypothetical road authority's expenditure for 2003-04. The road authority must earn $21.4 billion per year to cover the cost of road network maintenance and expansion and payments to State Governments of land tax and a 5 per cent rate of return on road and land assets.

Expenditure Item	Value ($m 2003-04)
Road maintenance and capacity expansion costs	8,380
Land tax payable	1,390
Rate of return required	11,600
TOTAL	**21,370**

Table 6.9: Hypothetical road authority expenditure items for 2003-04.

6.7.6 The road user deficit

The total revenue requirement for the hypothetical road authority in 2003-04 is $21.4 billion. Actual income from road users in 2003-04, from Section 6.7.4, was $17.7 billion. Thus, an updated estimate of the road user deficit is $3.7 billion. For comparison, Pender found an excess tax of $100 million on motorists in 1994-95. The change from an excess tax to a significant subsidy largely reflects changes in taxation arrangements since 1994-95, including abolition of the WST, reductions in fuel excise and suspension of fuel excise indexation. Road user charges have failed to keep pace with increases in the value of land under the road network (reflected in the land tax and rate of return on assets) and increases in expenditure on the road network.

The subsidy to road users reduces the cost of using the road network below what it would be in the benchmark case. Pender notes that the stock of vehicles does not appear to be sensitive to the cost of accessing or using the road network, so a subsidy to road users is unlikely to have much impact on the number of vehicles in Australia. However, the distance travelled is sensitive to distance-related costs (such as fuel price). This means that a subsidy to road users will tend to increase the distance travelled by road users and hence the GHG emissions (as road transport in Australia is almost entirely reliant on fossil fuels). It is reasonable to conclude that the road user deficit is a GHG emission subsidy, as long as fossil fuels remain the primary energy source for road transportation.

Subsidisation of road users is economically inefficient, as it prevents optimal use of the road network and other transport networks. In addition it will tend to increase congestion, accidents and noise, all of which have substantial economic costs. The Bureau of Transport Economics (BTE) estimated a congestion cost in Australia's major urban areas of $12.8 billion dollars per year (BTE 2000b). The estimate was based on the value of excess travel time and other resource costs, such as fuel use, incurred by the actual traffic in comparison to free-flow conditions. Another report by the BTE conservatively estimates the cost of road crashes in Australia at $15 billion per year (BTE 2000a). The estimate of the road user deficit developed here does not include any of these costs, or the costs of climate change, which are currently treated as externalities. Additional revenue from road users could be used to fund the development of sustainable fuels and transport alternatives that have fewer negative externalities.

In the sections below, I will consider additional road user subsidies that are not included in the estimate of the road user deficit.

6.7.7 Greenhouse Gas Abatement Program

As discussed in Section 6.6.1, GGAP provides funding for a program to reduce car reliance by encouraging walking, cycling, public transport and ride sharing. I have listed this subsidy in Table 6.10 as supporting renewable energy (walking and cycling), although some of the support for public transport may act as a fossil fuel subsidy, and the support for ride sharing is really a subsidy to energy efficiency rather than renewable energy. Using the assumptions discussed in Section 6.6.1, this subsidy was worth about $0.6 million in 2003-04.

6.7.8 Research and development

Total funding for transport R&D in Australia in 2002-03 was $157.1 million (ABS 2004e). Based on ABS figures, governments provided about $42 million of this R&D funding in 2002-03 (ABS 2004e, 2004f, 2004g, 2004h), or $43 million in 2003-04 dollars. As noted in Section 6.6.4, additional research funding is provided through the availability of tax concessions for business R&D, which amounted to $360 million in total in 2003-04 (Australian Government 2004g). In 2002-03, about 2.3 per cent of total business R&D expenditure was allocated to the transport sector (ABS 2004f). Assuming the tax concessions were taken up by businesses in the same proportion as total business sector research funds, the tax expenditure would amount to an additional $8.2 million in R&D funding for transport. This gives a total of $51 million in government R&D funding for the transport sector.

The proportion of this funding supporting fossil fuel production and consumption is uncertain, but likely to be high, as fossil fuels supply almost all energy requirements in the transport sector. As with the stationary energy sector, the proportion of total R&D funding supporting renewable energy is likely higher than the current contribution of renewable energy to total transport energy requirements. I have assumed that 90 per cent of total transport R&D funding supports fossil fuels and 10 per cent supports renewable energy, which is a similar proportion to that observed in the stationary energy sector but with slightly greater emphasis on fossil fuels. That is, $46 million supports fossil fuels and $5 million supports renewable energy. The fossil fuel subsidy is not a GHG emission subsidy, as much of the R&D focuses on reducing the environmental impact of transport or improving its efficiency.

6.7.9 Exemption from excise for alternative fuels

In Section 6.6.8, I estimated the magnitude of the transport sector subsidy associated with exemption from excise for alternative fuels as $527 million. While it was not possible to determine whether the net effect of this subsidy on GHG emissions was positive or negative in the stationary energy sector, the situation is somewhat clearer in the transport sector. Beer et al (c2003) examined the life cycle emissions associated with different transport fuels used by heavy vehicles and found that LPG and CNG had fewer GHG emissions over the full life cycle than the diesel typically used in heavy vehicles. A study on light vehicles is currently underway and similar results are expected. On this basis, the subsidy to alternative fuels in the transport sector is not a GHG emission subsidy. It should be noted, however, that the recent Fuel Tax Inquiry reported some reservations about the effectiveness of this subsidy in developing an alternative fuel industry (Fuel Taxation Inquiry Committee 2002). It is possible that the funds could be better spent on direct industry support.

6.7.10 Higher rate of excise levied on high sulphur diesel

To encourage the use of ultra low sulphur diesel in Australia, the Australian government has raised the excise rate on other diesel. The 2003 TES defines the excise rate on ultra low sulphur diesel as the benchmark for fuel excise. Consequently, the higher rate of excise levied on high sulphur diesel is reported as a negative tax expenditure of $135 million in 2003-04 (Australian Government 2004g). For consistency, this negative tax expenditure needs to be included in the total subsidy estimates. By raising the price of diesel it will reduce consumption and GHG emissions.

6.7.11 Excise free status for condensate

Condensate is a product of the petroleum industry that was granted excise free status in 1977. This is identified as a tax expenditure in the 2003 TES but no estimate of the value of the tax expenditure is available (Australian Government 2004g). This tax expenditure acts as a subsidy for consumption of condensate (e.g. as petrol in motor vehicles) and is likely to increase GHG emissions above what they would otherwise be. It also has a perverse impact on economic efficiency. However, as it is possible that this product might be wasted if it were subject to excise, caution must be exercised in contemplating removal of the subsidy.

6.7.12 Concessional rate of excise for aviation fuel

Aviation gasoline and aviation turbine fuel are subject to a lower rate of excise than unleaded petrol and diesel. The tax expenditure was $750 million in 2003-04 (Australian Government 2004g). This tax expenditure is a GHG emission subsidy, as it reduces prices of air travel and air freight below the benchmark level. This encourages both modal switching towards air transport and additional trips. Since air transport is the most greenhouse-intensive mode of transport per kilometre (IPCC 1999), both additional trips and modal switching towards air transport would increase GHG emissions above the benchmark level.

Deciding whether this subsidy is perverse is more difficult. If the subsidy were removed, aviation companies would have little choice but to pass the cost increase on to consumers in ticket and freight prices; there are no real alternatives to the use of aviation fuel for air travel. The result would be modal switching back to land transport and non-transport alternatives (e.g. video conferencing) and a reduction in total trips. This is not necessarily a good economic outcome; economies rely on exchanges, so a reduction in the number of trips and an increase in travel time (on land transport) could have a negative economic impact. Further investigation would be necessary to determine whether removal of this subsidy would increase overall economic efficiency. For now, I have not classified it as perverse.

6.7.13 Energy Grants Credits Scheme: on-road component

In Section 6.6.6, I discussed the off-road component of the EGCS. Here, I discuss the on-road component, formerly known as the Diesel and Alternative Fuels Grants Scheme (DAFGS). The on-road component of the EGCS provides grants for use of diesel, CNG, LPG, liquefied natural gas (LNG), ethanol and biodiesel used in road transport by heavy vehicles. The scheme provides particular support for use of these fuels by primary producers. The cost of the on-road component of the EGCS was $830 million in 2003-04 (Australian Government 2003a). This is a direct financial subsidy to the use of diesel and alternative fuels for road transport in Australia.

The proportion of this subsidy that supports fossil fuels is uncertain. Some proportion of the subsidy supports renewable fuels such as ethanol and biodiesel. However, the volume of diesel, LNG and CNG consumed in Australia is much higher than that of renewable fuels. In 1997-98, consumption of diesel was roughly three times the consumption of LNG/CNG, with other alternative fuels having much smaller consumption rates (ABS 2001b). A conservative assumption is that 90 per cent of the DAFGS funding is taken up by fossil fuel users and 10 per cent by renewable fuel users. This amounts to a fossil fuel subsidy of about $747 million and a renewable energy subsidy of about $83 million.

It is likely that the fossil fuel subsidy is a GHG emission subsidy. While combustion of diesel, LNG and CNG generates lower emissions than combustion of an equivalent amount (based on energy content) of petrol, it is unlikely that the EGCS is stimulating fuel switching from petrol. It is more likely that existing users of diesel and alternative fuels will instead be encouraged to drive more by the lower net prices for the fuels. This will result in GHG emissions above the benchmark level.

The intent of the EGCS is to reduce the cost of fuel to businesses, particularly in rural and regional areas. This is linked to objectives of regional development and economic growth. These objectives could equally be met through funding that is not tied to fuel consumption. However, this does not mean that the EGCS is a perverse subsidy. As fuel is a significant input to businesses that can receive the EGCS, the subsidy is likely to be an efficient way to stimulate greater economic activity by those businesses.

6.7.14 Fuel Sales Grants Scheme

The Fuel Sales Grants Scheme (FSGS) pays grants to fuel retailers and distributors of petrol and diesel in regional and remote areas of Australia. It was established to prevent rises in regional fuel prices as a result of the implementation of the GST in Australia. The cost of the FSGS was $220 million in 2003-04 (Australian Government 2003a). This is a direct subsidy to retailers of fossil fuels, which must be passed on to consumers as a condition of the grant.

As the FSGS reduces the price of fuel in regional and rural areas, it encourages greater consumption of fuel in these areas, and hence greater GHG emissions. It is reasonable to conclude that the subsidy is a GHG emission subsidy. However, the subsidy is not necessarily perverse, as it is a relatively efficient way to achieve the government's stated objective of preventing fuel price rises in the targeted regions. As for the on-road component of the EGCS, the driving objective of the FSGS is regional and rural economic development. This objective could be equally met without tying the funding to fuel consumption.

6.7.15 Petroleum Products Freight Subsidy Scheme

The Petroleum Products Freight Subsidy Scheme (PPFSS) is a national subsidy scheme providing assistance to offset the cost of freighting eligible petroleum products to remote Australian places. The PPFSS acts to benefit purchasers in those places by reducing the freight component of the purchase price of fuel. The PPFSS covers automotive distillate, motor spirit, aviation gasoline and aviation turbine fuel. In 2003-04, this subsidy was worth $3.6 million (Australian Government 2004d). The subsidy is a GHG emission subsidy as it reduces the cost of petroleum products in regional areas to below the unsubsidised level, and thereby encourages greater fuel consumption. It is also perverse, because it distorts the real market price for supplying petroleum products to remote areas.

6.7.16 Cleaner Fuels Grants Scheme

The Cleaner Fuels Grants Scheme was introduced in September 2003 to provide grants for licensed excise manufacturers and importers of eligible cleaner fuels. The scheme was established to offset the excise and customs duty payable on alternative fuels. To date, biodiesel is the only cleaner fuel defined under the scheme. Consequently, the scheme provides a renewable energy subsidy. Its value in 2003-04 was $15 million (Australian Government 2004f).

6.7.17 Tax benefits for cars provided by employers

Employers that provide vehicles or other benefits for use by employees in Australia are liable for Fringe Benefits Tax (FBT). Two methods may be used to calculate liability for FBT: the operating cost method and the statutory formula method. The operating cost method accounted for only 7 per cent of total motor vehicle FBT in 1998-99 (Australian Taxation Office 2001). It requires a logbook to be kept to determine actual operating costs and the actual proportion of the time that the car is in private use. The benefit to which FBT applies (the taxable value) is then equal to the private fraction of the actual vehicle operating costs as determined from the logbook.

The statutory formula method determines the taxable value to which FBT applies by multiplying the purchase value of the vehicle by a statutory percentage that varies with total distance travelled by the car during the year. The greater the distance travelled, the lower is the taxable value. This method accounted for 93 per cent of total FBT paid on motor vehicles in 1998/99 (Australian Taxation Office 2001). The method assumes that the greater the distance travelled by the vehicle, the lower the proportion of private use and hence the lower the fringe benefit to the employee. This acts as a clear incentive to drive further and hence to consume more fuel and generate more GHG emissions.

The Australian Government recognises that the use of the statutory formula provides a concession to taxpayers and therefore includes an estimate of the financial impact of this arrangement in the 2003 TES. The tax expenditure associated with the application of the statutory formula to value car benefits was estimated at $1.07 billion for 2003-04 (Australian Government 2004g). As this tax expenditure encourages employees to drive further, it is a GHG emission subsidy. The subsidy does not appear to be tied to any specific government objective, other than to simplify record keeping for employees with company cars. This objective could be met without encouraging greater driving. As the subsidy distorts the true cost of driving, and its objectives can be met in other ways, I have categorised it as a perverse subsidy.

6.7.18 Alternative Fuels Conversion Program

The Alternative Fuels Conversion Program (AFCP) assists operators and manufacturers of heavy commercial vehicles and buses to convert to CNG or LPG, through grants to offset conversion and upgrade costs and purchase of new vehicles. Government funding for the AFCP was $8.2 million in 2003-04 (Kemp 2004). The AFCP supports the use of fuels that generate fewer life cycle GHG emissions than the diesel fuel that is typically used in heavy commercial vehicles and buses. Therefore, this subsidy is not a GHG emission subsidy.

6.7.19 Automotive industry support

The Australian Government provides direct support to the automotive industry in Australia through the Automotive Competitiveness & Investment Scheme (ACIS). This scheme is budgeted to provide $400 million per year over the five years from 2001 to 2005 to encourage investment and innovation in the Australian automotive industry.

This direct support for the Australian automotive industry could theoretically allow the industry to sell motor vehicles at lower prices, which could increase the number of vehicles on the road. However, in practice, the automotive industry may choose to take increased profits, rather than lower vehicle prices. In addition, the low sensitivity of vehicle stock to vehicle price (Pender 1999) means that lower vehicle prices are unlikely to lead to a significant increase in stock. It is therefore not possible to unequivocally link this subsidy to greater consumption of fossil fuels. Therefore, the subsidy is not listed in Table 6.10.

It should be noted, however, that support for the automotive industry helps to lock in the existing dominance of motor vehicle transport over alternative forms of transport, and maintains a situation where fossil fuels are the main source of transport energy. Although the ACIS is not strictly a subsidy to fossil fuels, it does act to support the dominance of fossil fuels. Removal of this subsidy, and transfer of the funds to development of alternative transport, could help to significantly reduce transport emissions in the long-term.

6.7.20 Magnitude of transport subsidies

Table 6.10 summarises transport subsidies and identifies those fossil fuel subsidies that are GHG emission subsidies and perverse subsidies. Total fossil fuel subsidies amount to $6.9 billion, whereas total renewable energy subsidies amount to $104 million.

Subsidy or Incentive	Annual FF Support ($m)	Annual RE Support ($m)	Subsidy Category	
			GHG Emission?	Perverse?
General Transport Subsidies				
Greenhouse Gas Abatement Program	-	0.6	No	No
Research and development	46	5	No	No
Road Transport Subsidies				
Road user deficit	3,700	-	Yes	Yes
Excise exemption for alternative fuels	527	-	No	No
Higher rate of excise levied on high sulphur diesel	-135	-	No	No
Excise exemption for condensate from petroleum industry	Not estimated	-	Yes	No
Energy Grants Credits Scheme	747	83	Yes	No
Fuel Sales Grants Scheme	220	-	Yes	No
Petroleum Products Freight Subsidy Scheme	3.6	-	Yes	Yes
Cleaner Fuels Grants Scheme	-	15	No	No
Availability of statutory formula method for FBT on employer-provided cars	1,070	-	Yes	Yes
Alternative Fuels Conversion Program	8.2	-	No	No
Aviation Transport Subsidies				
Concessional rate of excise for aviation fuel	750	-	Yes	No
CATEGORY TOTALS ($m)	**6,937**	**104**	**6,364**	**4,639**

Table 6.10: Summary and categorisation of transport subsidies.

6.8 Discussion and conclusions

In this final section, I summarise the subsidy estimates developed in this chapter (Section 6.8.1), draw out conclusions about the impact of subsidies on the relative costs of fossil fuels and renewable energy (Section 6.8.2), note other possible subsidies that are not included in these estimates (Section 6.8.3) and discuss subsidy removal (Section 6.8.4).

6.8.1 Summary of subsidies

Table 6.11 summarises identified subsidies to fossil fuels and renewable energy in the stationary energy and transport sectors. It is immediately clear that fossil fuels receive substantially more support across all the sectors considered. Total fossil fuel subsidies are between $8.5 billion and $8.6 billion per year, while the high estimate of total renewable energy subsidies is only $254 million per year. Of the total fossil fuel subsidies, about $7.5 billion (88 per cent) are GHG emission subsidies and about $5.3 billion (62 per cent) are perverse. Most of the fossil fuel subsidies occur in the transport sector; about 81 per cent are transport subsidies, 6 per cent are electricity subsidies and 13 per cent are other stationary energy subsidies.

Sector	Annual FF Subsidy ($m)	Annual GHG Emission Subsidy ($m)	Annual Perverse Subsidy ($m)	Annual RE Subsidy ($m)
Electricity subsidies	443-480	443-480	195-232	67-70
Other stationary energy subsidies	1,119-1,175	676-714	434-472	45-80
Transport subsidies	6,937	6,364	4,639	104
CATEGORY TOTALS ($m)	**8,499-8,592**	**7,483-7,558**	**5,268-5,343**	**216-254**

Table 6.11: Summary of the magnitude of identified subsidies to fossil fuels and renewable energy in the stationary energy and transport sectors.

6.8.2 Impact on the relative costs of fossil fuels and renewable energy

The total identified renewable energy subsidies, across the stationary energy and transport sectors, amounted to between 2.5 and 3 per cent of the total energy and transport subsidies. Renewable energy fares best in the electricity sector, where it receives between 12 and 14 per cent of total electricity subsidies. In the remainder of the stationary energy sector, renewable energy receives from 4 to 7 per cent of total subsidies. In the transport sector, renewable energy receives only 1.5 per cent of total subsidies. The discrepancy between fossil fuel and renewable energy subsidies is certainly sufficient to distort the price of fossil fuels relative to renewable energy. I would therefore conclude that the unsubsidised price differential between fossil fuels and renewable energy, even before externalities are included, is somewhat less than is usually assumed.

Some simple calculations help to illustrate the impact of existing fossil fuel subsidies on energy prices and GHG emissions. These calculations are only meant to be indicative – detailed analysis of the impact of individual subsidies, taking into account specific subsidy removal mechanisms, would be necessary to provide more accurate impact assessment. Based on figures from ABARE, electricity generation from fossil fuels was about 207,000 GWh in 2001-02 (Akmal et al 2004).

Dividing the total fossil fuel subsidy in the electricity sector by the total generation gives a price distortion of $2.30 per MWh. This is certainly not sufficient to create the observed cost differential between fossil fuel generation and renewable energy generation; as discussed in Section 3.7.3, the cost differential between coal-fired power and wind power in Australia is about $40 to $50 per MWh.

NIEIR (2004) reports a long-run price elasticity of electricity demand in the NEM of –0.35. Assuming an electricity price at the customer of 10 cents per kWh ($100 per MWh), subsidy removal would increase prices by about 2.3 per cent and long-term electricity demand would fall by only 0.8 per cent. Based on Australia's 2002 National Greenhouse Gas Inventory (AGO 2004c), this would correspond to an emission reduction of 1.5 Mt CO_2-e. For comparison, the projected emission reduction from existing measures in the stationary energy sector in 2010 is 31.2 Mt CO_2-e. Although the GHG emission reduction associated with subsidy removal is small, I did not attempt to quantify many of the subsidies, cross-subsidies and structural incentives for electricity consumption. The impact of addressing these other structural issues could be significant.

In the transport sector, road transport consumes about 25.5 GL of petroleum products each year (Akmal et al 2004). Therefore, the total fossil fuel subsidy in the road transport sector creates a price distortion of about 0.7 cents per MJ or 27 cents per litre. This *is* significant, given that the price of motor vehicle fuel in Australia is around $1 per litre. Further, according to Australian Government estimates of the costs of different fuels (DPMC 2004, p.91), a price distortion of this magnitude could make certain alternative fuels competitive with petroleum on cost. Petroleum costs about 1 cent per MJ, whereas biodiesel costs from 1 cent to 2.4 cents per MJ, methanol costs from 2.2 to 3.5 cents per MJ and ethanol costs from 2.6 to 3.7 cents per MJ (DPMC 2004, p.91). If the fossil fuel subsidies were removed and petroleum prices rose by 0.7 cents per MJ, biodiesel would become competitive.

The long-run price elasticity of demand for petrol is –0.58 (AGO 1999). Thus, the 27 per cent price increase associated with subsidy removal would correspond to a 16 per cent reduction in petrol demand. Based on Australia's 2002 National Greenhouse Gas Inventory (AGO 2004c), this would correspond to an emission reduction of 11 Mt CO_2-e. Although this is a significant reduction, its achievement would depend on the details of subsidy removal and the availability of renewable transport alternatives. At present, it is more likely that consumers would have no choice but to absorb most of the price increase.

I will not attempt to estimate the price or emission impact of other stationary energy subsidies, as they are spread across many different fuels. However, based on the size of the subsidy and the total stationary energy consumption, I would expect the price impact to be closer to that observed in the electricity sector than that observed in the transport sector.

The impact of subsidy removal in the electricity and other stationary energy sector is unlikely to be sufficient to provide significant impetus for development of the renewable energy industry, although it could certainly provide assistance when combined with other measures. However, subsidy removal in the transport sector has significant potential as a mechanism to aid the development of an alternative transport fuel industry. These benefits of subsidy removal are in addition to any improvements in economic efficiency and reductions in GHG emissions that might result. A large proportion of the transport subsidies (67 per cent) are categorised as perverse, which means that their removal should deliver both economic and environmental benefits. Nevertheless, subsidy removal requires careful planning and attention to social equity if these benefits are to be captured.

6.8.3 Possible subsidies not estimated

The subsidy estimates in this chapter are approximate and incomplete, given the difficulty in accessing information to estimate some subsidies, other estimation difficulties and constraints on the time available to investigate potential subsidies. The 2003 TES lists tax expenditures, not discussed elsewhere in this chapter, which could potentially act as fossil fuel subsidies depending on the details of their implementation. These include:

- The availability of alternatives to the actual expenses method of substantiating employment-related car expenses
- FBT exemption for employee taxi travel arriving at or leaving from place of work
- Reimbursement of car expenses incurred with occupational health and counselling services and some training courses
- FBT concession for car parking on small business premises
- FBT exemption for certain car parking fringe benefits, including benefits provided by employers who are non-profit scientific organisations, charitable institutions, religious institutions or public education institutions
- FBT undervaluation of benefits resulting from valuation arrangements for car parking
- FBT exemption for private use of a taxi, panel van, utility or other vehicle where the use is minor and infrequent, including use for home-to-work travel
- FBT exemption for fuel for live-in employees caring for the elderly or disadvantaged
- FBT reduction of the taxable value for residential fuel for remote area housing provided by employers
- Discounted valuation of employee stand-by travel for airline employees and travel agents
- FBT exemption for up to $500 per employee of the taxable value of airline transport fringe benefits
- FBT reduction in the taxable value of holiday travel for employees posted overseas

- Capital expenditure incurred on connecting or upgrading mains electricity to a property on which a business is conducted can be depreciated on a ten-year prime cost basis
- Accelerated depreciation for mining buildings.

Many of these potential subsidies are of small size relative to the subsidies considered in this chapter, so I did not prioritise further investigation. However, these subsidies would be suitable for further research in the future.

Other subsidies that were identified and discussed in previous sections, but for which a value could not be readily estimated include:

- Subsidies arising from take-or-pay contracts and government underwriting of fossil fuel development projects
- Cross-subsidies arising from electricity pricing structures that encourage greater fossil fuel consumption
- Subsidies arising from the greater scale and degree of centralisation of fossil fuel power stations
- Subsidies for network augmentation when cheaper alternatives are available.

Further research on these subsidies would also be useful. In addition, there are undoubtedly other subsidies that I have not identified.

6.8.4 Subsidy removal

A clearer understanding of fossil fuel subsidies is of little use if not linked to a clear process for subsidy removal or reform. The Australian Conservation Foundation has proposed a national inquiry into environmentally damaging government programs and subsidies and environmental tax reform. Subsidies that support fossil fuel production and consumption would only be one of the areas examined (Krockenberger, Kinrade & Thorman 2000).

The inquiry could be established as a parliamentary inquiry. This would allow access to a much greater range of information than was available for the current research, provide greater resources for subsidy estimation and offer a possible link to an official process for subsidy removal. Government commitment to such an inquiry would be essential if its recommendations were to be successfully implemented. However, in a political climate in which the resource-based discourse coalition is dominant, the likelihood of establishing such an inquiry seems low.

For any government contemplating subsidy removal or reform, the question of what to do with the newly available funds arises. Rather than returning the funds to general revenue, an opportunity exists to shift existing subsidies from fossil fuels to sustainable energy systems, incorporating energy efficiency and renewable energy. Such subsidisation can be justified to offset the unpaid social and environmental costs of competing fossil fuel technologies. I would also argue that temporary subsidies to emerging industries of strategic importance are justified until such industries can compete with more established industries. The public funds currently used to subsidise fossil fuel production and consumption could justifiably be used to subsidise the emerging sustainable energy industry, as establishment of this industry would constitute a public good. Given evidence that fossil fuel technologies have benefited from at least $40 billion in subsidies since World War Two (ECITA Committee 2000, p.158), it is quite reasonable to provide corresponding support for sustainable energy.

From an integral perspective, it is crucial than any program of subsidy removal is sensitive to psychological and cultural impacts as well as economic and environmental impacts. For example, removal of fossil fuel subsidies in the transport sector would significantly increase fuel prices in a culture that is car-dependent and, in many parts of Australia, has no viable alternative transport forms. Many households would have little choice but to pay higher fuel costs, bringing negative economic and psychological impacts. Subsidy removal should only be pursued gradually, in tandem with programs that develop viable alternatives to fossil fuels.

7. A Developmental Perspective on Climate Policy Discourse

> The leading paradigm in the social sciences is homo economicus – economic man. Economic man looks after himself, in competitive struggle with others. Now, if people come to think that we are all, always, like this, their relations with each other become different. They become less trusting, less cooperative, more suspicious. This changes the way they interact, and they will incur various costs. They will find it harder, and in some circumstances impossible, to get cooperative ventures going: they may get stuck in what the philosopher Thomas Hobbes (1588-1679) memorably called 'the war of all against all'.
>
> - Simon Blackburn, *Think* (1999).

> We tell people that they are selfish and it is not surprising that they become more so. Robert Frank asked students at Cornell whether they would report it if they were undercharged for a purchase, and whether they would return a lost addressed envelope which contained $100. They were asked in September and again in December after one term's work. Students who took introductory economics became less honest, while astronomy students became more honest, and the difference was significant.
>
> - Richard Layard, *Lionel Robbins Memorial Lecture*, 2003

7.1 Introduction

From Chapter 6, with its focus on the objective structure of economic systems, I now shift focus to the cultural quadrant and the structure of policy discourse. The discussion and analysis in this chapter draws together several threads from earlier chapters. In Chapter 2, I outlined the integral theory of development and discussed its application to the cultural quadrant. Using various forms of structuralism, including discourse analysis, integral theorists such as Gebser ([1949] 1985), Habermas (1979) and Wilber (2000c) have reconstructed the historical emergence of distinct cultural structures and worldviews that persist today. I mentioned archaic, magic, mythic, rational and integral cultural structures, but did not discuss the characteristics of these structures. One of my objectives in this chapter is to outline the characteristics of these cultural structures and explore their implications for climate policy.

In Section 4.9, I examined the application of discourse analysis to environmental politics and climate policy. There, I briefly outlined Dryzek's (1997) environmental discourses, the climate policy discourses identified by grid-group cultural theorists and Bulkeley's (2000b) discourse coalitions in the Australian climate policy network. I am interested in exploring how these alternative discourse descriptions relate to each other and to the cultural structures identified by integral theorists. There are three issues of particular interest.

First, the development of a theory and method that can cope with cultural complexity has become an important area of focus in cultural studies, sociology and anthropology (Couldry 2000). The postmodern insight into the social construction of reality reveals that culture and context are central to the way subjects interpret reality. However, in extreme forms, this insight is used to argue that every perspective is equally valid, posing problems for policy makers seeking to take practical action without marginalising different perspectives. For cultural and political theorists, a key question is how to achieve a balance between postmodern sensitivity to cultural diversity and plurality and the practical demands of policy, decision-making and daily life. Integral theory and the three discourse approaches described in Section 4.9 adopt different responses to this question. I believe that a comparison of these responses will contribute to the development of a theory of cultural complexity.

Second, the developmental aspect of integral theory in the cultural quadrant is controversial. As discussed in Section 2.3.6, integral theory has been accused of imposing hierarchical meta-narratives on subjects and of marginalising particular perspectives by labelling them as less developed. The discourse approaches described in Section 4.9 adopt different stances towards notions of cultural development. Dryzek (1997, p.5 & 18) is open to the idea that discourses develop but does not attempt to relate discourses developmentally. Grid-group cultural theorists are generally hostile to evolutionary assumptions, arguing that discourses are abiding positions that exist in a dynamic, shifting balance with each other. Bulkeley (2000b) does not address cultural development. I wish to explore the consistency of a developmental perspective with the three different discourse approaches to determine how integral theorists might sensitively respond to critics of cultural development.

Finally, in Chapter 5, I confirmed Bulkeley's (2000b) observation that a resource-based discourse coalition dominates Australian climate policy and effectively excludes other discourses. I argued there, drawing on deliberative and discursive democratic theory, that inclusion of a wider range of discourse perspectives in policy making can bring personal, political and social benefits. Another objective of this chapter is to identify excluded policy discourses and begin to address the question of how to include these discourses in policy making. I will take up this question in more detail in Chapter 8.

My guiding research question in this chapter is:

- How can integral theory contribute to theoretical and practical understanding of environmental and climate policy discourse?

In approaching this question, I begin (in Section 7.2) by outlining an integral theory of environmental discourse, drawing partly on the work of other integral theorists and partly on my own thinking and interpretation. Central to this theory are cultural structures that have emerged over the course of human history. I examine the ways in which these cultural structures underpin different environmental attitudes. In Section 7.3, I develop an integral interpretation of Dryzek's (1997) environmental discourses, demonstrating the plausibility of developmental theories of discourse. In Section 7.4, I consider the more antagonistic relationship between integral theory and grid-group cultural theory and seek a rapprochement. In Section 7.5, I reframe discourse coalitions in integral terms. Finally, in Section 7.6, I draw conclusions linked to the research question and objectives outlined above.

My method in this chapter is best described as meta-discourse analysis. I do not develop new discourse descriptions through collection of original data. Instead, I examine discourse descriptions by multiple authors that have themselves conducted discourse analysis. I look for internal consistency, consistency across discourses described by different authors and explicit or implicit relationships between discourses.

7.2 An integral theory of environmental discourse

In this section, I outline an integral theory of environmental discourse, drawing on the work of Gebser ([1949] 1985), Wilber (1999; 2000c) and Habermas (1979) and my own thinking and interpretations. My objective in outlining this theory is to provide a basis for comparison with the other discourse approaches considered in this chapter. In Section 7.2.1, I provide an all-quadrants perspective on environmental discourse. In Section 7.2.2, I describe my understanding of discourse as the interaction of multiple developmental streams in the cultural quadrant. Finally, in Section 7.2.3, I examine the development of environmental attitudes during human history and link this development to the cultural structures identified by integral theorists.

7.2.1 An all-quadrants perspective on environmental discourse

I provided a definition of discourse in Section 2.5.5, drawing particularly on Dryzek (1997). It is worth restating Dryzek's (1997, p.8) definition here:

> A discourse is a shared way of apprehending the world. Embedded in language, it enables those who subscribe to it to interpret bits of information and put them together into coherent stories or accounts. Each discourse rests on assumptions, judgments, and contentions that provide the basic terms for analysis, debates, agreements, and disagreements.

In other words, a discourse is a cultural structure that expresses the shared meanings and worldviews of a particular group (or collective holon). On this basis, discourse is clearly an element of the cultural quadrant. However, the quadrants are just four different perspectives on a holon, so any discourse must have corresponding elements in the behavioural, systemic and psychological quadrants. I will examine these elements and the ways they interact below.

Starting with the psychological quadrant, it is evident that every individual has a unique set of psychological structures, including values, morals and cognitive structures, that shape the way they understand and interact with other individuals. Kahn (1999), in his exploration of the human relationship with nature, shows how important these psychological structures are in shaping environmental attitudes. Discourses, including environmental discourses, emerge when individuals share enough of these structures to reach a degree of mutual understanding. Of course, at the same time, discourses shape individual values, for example by providing language with which to structure and express those values.

Similarly, developmental processes in the psychological quadrant influence cultural development, and vice versa. Individuals that develop past the average developmental wave in a group provide a driver for ongoing cultural development. Individual explorations of emergent postconventional value structures provide an example that other members of the group can adopt, leading to the gradual development of new structures of consciousness in the cultural quadrant. The various environmental discourses that I will describe in Section 7.2.3 can often trace their origins to the work of pioneering individuals, operating from postconventional value commitments.

However, it is important to recognise that a discourse is never a simple 'aggregation of individual-level preferences, attitudes, and sensibilities' (Dryzek 1997, p.170). Social structures, including institutions, rules and practices, can frustrate the cultural expression of personal values, so that the values associated with a shared discourse may be quite different to the average of individual values. At the same time, a discourse will tend to prioritise particular kinds of social practices that can consequently become embedded as institutions in the systemic quadrant. Both Dryzek (1997; 2000) and Bulkeley (2000b) explicitly recognise the close relationship between environmental discourses and social institutions in the systemic quadrant (see Section 4.13.2).

Wilber argues that the systemic quadrant has a particularly strong influence on the cultural worldview of a society, due to the socialising role of the systems of institutions, practices and rules that characterise a society. Wilber (2000b, pp.145-146) elaborates:

> For example, to say that a given society is at a magical level of development does not mean that everybody in that society is at that level. It only means that the average level of consciousness is generally magical, and that, more specifically, the defining laws, principles of cultural organization, and mores of everyday reality stem predominantly from the magical worldview.

This means that dominant cultural discourses will tend to be strongly embedded in the systemic quadrant via social practices, institutions and technologies. The implication is that systemic change will provide a strong driver for changes in cultural discourses or the interactions between discourses. Wilber (2003a, Part III, p.1) points out that a change in the material reality of the systemic quadrant can happen very quickly. The rapid emergence of personal computing and the

Internet is one example. However, it takes time for cultural values and beliefs to adjust to this new material reality. It is changes in the systemic quadrant, therefore, that typically drive cultural development.

The systemic quadrant is also important for a discussion of environmental discourse because the ecological systems that are the topic of environmental discourse are associated with the systemic quadrant. Thus environmental discourse must engage, to varying degrees, with the concepts and methods of the systemic quadrant.

From a behavioural perspective, individual behaviour is at least partly an expression of a particular discourse commitment and is constrained by what is accepted in that discourse. In addition, the biological realities of brain and organism structure shape the kind of values that will resonate with humans. Values that suit the human biological disposition are more likely to provide a suitable foundation for shared discourses.

The discussion in this section is a reminder that no quadrant can be considered in isolation from the others. While I find it convenient in this chapter to focus primarily on the cultural quadrant, and discourse in particular, the influence of the other quadrants cannot be ignored.

7.2.2 Developmental streams in environmental discourse

Drawing on Dryzek's definition and my own thinking, I interpret discourse as broader than any single developmental stream identified by cultural theorists. Like the cultural centres of gravity described by Gebser ([1949] 1985), Wilber (1999; 2000c) and Habermas (1979), discourses combine developmental waves from multiple developmental streams. They comprise linguistic structures, worldviews, ethical positions, myths, metaphors and shared assumptions. They also offer a site for expression of individual values, morals, needs, identities and cognitive structures. A discourse comprises different combinations of developmental waves across these (and other) streams. Thus, the more of these streams considered in a discourse description, the greater the explanatory power of that description.

However, as discussed in Section 7.1, a balance must be sought between exhaustive description of cultural complexity and the practical political requirement to act with incomplete knowledge. In the discourse descriptions in this chapter, I have sought such a balance by focusing on those developmental streams that I have judged to have the most influence on environmental discourse. Some of the important streams emerged from my review of climate policy discourses in Section 4.9. I discussed others in Sections 2.3.5 and 2.3.6. Below, I will briefly outline those streams to which I devote most attention in the discourse descriptions in Section 7.2.3 and throughout this chapter.

Dryzek (1997, p.16) identifies the basic entities recognised or constructed by a discourse as a defining feature of environmental discourses. The **cognitive** development of individuals participating in a discourse is important here. It is only with the emergence of formal operational cognition that ecological systems emerge as recognisable entities (I will return to this point in Section 7.2.3). The cognitive structures of individuals participating in a discourse are crucial in determining what the discourse can recognise and how it interprets reality.

Dryzek (1997, pp.16-17) also emphasises variation in assumptions about natural relationships and **metaphors** across discourses. Similarly, grid-group cultural theorists draw attention to different **myths** of nature that underlie discourses (e.g. Thompson & Rayner 1998a) and Bulkeley (2000b) discusses **storylines** associated with different discourse coalitions. The stories told about the natural and human world are crucial to distinguishing discourses.

Although not stressed by the authors cited above, I believe that **ethical positions** and **group inclusiveness** are also important distinguishing characteristics of discourses. Environmental discourse is radically different in a group that extends membership to all living things, compared to a group that extends membership only to those humans that share a particular belief system. Group ethics and inclusiveness are linked to the development of individual **identity**, from egocentric, to sociocentric or ethnocentric, to worldcentric. Individual **moral** development, from preconventional, to conventional, to postconventional, is also relevant. I discussed these developmental streams in Section 2.3.5.

Individual **values** and group **worldviews** are also defining features of discourses. In Section 2.3.5, I outlined seven stages in the development of individual values, drawing on Beck and Cowan (1996), Wilber (2001) and my own interpretations. Although these stages describe psychological development, there is strong evidence, discussed in the next section, that these stages parallel the historical development of cultural worldviews. I will draw on descriptions of these value stages throughout this chapter.

Finally, where appropriate, I also discuss developments in the systemic quadrant due to the important influence of **material development** on cultural worldviews, outlined in Section 7.2.1. Cultural development is often a response to changing material conditions, particularly on a historical scale. It is to the historical development of environmental worldviews that I now turn.

7.2.3 Environmental attitudes through human history

In this section, I trace the development of attitudes towards nature through human history. To structure the discussion, I use the cultural structures of consciousness identified by Gebser ([1949] 1985), Wilber (1999; 2000c) and Habermas (1979) and briefly introduced in Section 2.3.6. These authors identify archaic, magic, mythic, rational and integral structures of consciousness (or worldviews) that have emerged in human cultures over time. I outline the general characteristics of each worldview or structure, how it relates to previous and subsequent worldviews and the environmental attitudes that it supports. While I draw on general descriptions of each worldview by the authors cited above, much of the interpretation of the environmental elements of each worldview is my own.

Although I describe a sequential progression from one worldview to the next, the reality is, of course, far more complex. First, history is not a single story. Many different cultures have followed their own developmental path, with substantial variations across cultures. The structures of consciousness discussed below are an attempt to identify deep underlying developmental structures that are shared across cultures; they do not attempt to capture the rich variety of ways in which these deep structures are expressed.

Second, human history is not a story of inexorable progress. Civilisations rise and collapse and cultures may develop through the different structures of consciousness only to regress again. In any developmental process, things can go wrong. The new abilities that emerge with a new stage of development bring new and more complex problems to solve; this is the dialectic of progress. Nevertheless, although history is not a linear story, evolutionary processes do tend to advance, building on previous successes and discarding failures. The story told through the structures of consciousness is the story of the successes – those changes in worldview that have brought such clear benefits or offered such important solutions to pressing problems that they have been widely adopted across cultures.

Finally, the sequential and historical presentation of the structures of consciousness hides the fact that all of the structures described below exist, in some form, in the present. No structure is ever completely dominant in any historical period. I will argue, in essence, that these structures of consciousness underpin multiple coexisting discourses. Individuals move through these discourses as they develop. Each of us must start from the archaic structure of consciousness.

The archaic structure

The archaic structure of consciousness, for both Wilber and Gebser ([1949] 1985), 'represents *all* the structures of consciousness up to and including the first hominids' (Wilber 2000c, p.169). It is the worldview of foraging tribes, characterised by purely symbolic representations of the world. At the archaic stage, the noosphere has not yet begun to differentiate from the biosphere.[57] That is, there is no human mind distinct from the environment, and therefore no identifiable attitude towards nature. For humans with an archaic structure of consciousness, the environment literally does not exist. Today, newborn infants continue to display the archaic structure of consciousness but, given the absence of language to support the development of mutual understanding, there is no corresponding archaic environmental discourse. Cognition at this stage is purely sensori-motor and values are instinctual, focused entirely on individual survival.

[57] See Section 2.3.2 for a description of the physiosphere, biosphere and noosphere.

Habermas (1979, pp.135-136) describes the breakdown of the undifferentiated archaic state as a response to problems created by the division of labour between males and females in hominid society. Males formed cooperative hunting bands, while females gathered food and cared for the young. The role of the father within a family system, which had not previously existed, arose as a way of coordinating the functions of the male and female groups. For Habermas, it is the emergence of the family that marks the transition from hominid to human. This is the point at which the archaic structure is succeeded by the magical-animistic structure (Wilber 2000c, p.169).

The magic structure

The magic structure is recognised by Gebser ([1949] 1985, pp.45-60), Habermas (1979, p.104) and Wilber (2000c, pp.169-176). It arose with the emergence of the father role in Palaeolithic tribal (horticultural) societies and marked the earliest stage of the differentiation of mind from body, or noosphere from biosphere. The father role allowed the development of extended families, or tribes, linked by kinship. Societies exhibiting a magic structure of consciousness were bound together by blood lineage; their collective identity stemmed from their direct relationship to a common ancestor (Habermas 1979).

Cognitively, the magic structure in the cultural quadrant correlates closely to Piaget's preoperational structure in the psychological quadrant, which 'works with images, symbols, and concepts (but not yet complex rules and formal operations)' (Wilber 2000c, p.170). In preoperational thought, the differentiation of mind and biosphere is only beginning, so physical and mental events are often confused. As a result, this structure is characterised by a belief that mental intentions can alter the physical world through symbolic magic, and that physical objects have their own mental life (animism). For humans at the magical structure of consciousness, trees, mountains and rivers possess explicit personal intentions (Wilber 2000c, p.171).

The average stage of self-identity in magical cultures is egocentric, the average stage of moral development is preconventional (Wilber 2000c) and values are magical-animistic. These developmental structures are evident today in children up to about the age of six (Wilber 2001), although they can persist as important structures into adulthood.

Tribal, magical societies are often eulogised for their ecological wisdom and closeness to nature. However, this closeness was not a conscious choice; it simply meant that differentiation of the noosphere from the biosphere was only beginning. In fact, a close examination of the historical evidence indicates that tribal societies did not possess any special ecological wisdom (Wilber 2000c), although their closeness to nature in their daily lives may have allowed a sharper perception of the natural world (Abrams 1996). Instead, magical societies simply lacked the technological means to inflict ecological destruction on a modern scale (Wilber 2000c). Environmental discourse, for magical societies, comprised a close communion with the magical spirits swirling around the tribe.

This communion was an attempt to placate the spirits in order to preserve the unity of the tribe. Ecological awareness, as it is understood today, had not yet developed in any widespread form.[58]

The inherent limitations of the magical structure stemmed from the central importance of tribal kinship. Isolated tribes, linked by a common ancestor and a local mythology, were unable to integrate other tribes into their social and cultural structures. Encounters between different tribes usually resulted in conflict. For sociocultural evolution to continue, some way of integrating conflicting tribal objectives was required. As Habermas (1979) and Wilber (2000c) point out, the emergence of a mythic structure provided the basis for this integration.

The mythic structure

The mythical structure of consciousness first appeared on a widespread basis in the early agrarian states and empires. Whereas the collective identity of magical tribes relied on kinship, the collective identity of mythic states relied on a common ruler 'who could claim close connection and privileged access to the mythological originary powers' (Habermas 1979, p.112). That is, in mythic societies, political relations transcended kinship relations as the basis of social integration (Habermas 1979). This allowed the expansion of social groupings to incorporate members of other tribes, as 'equal citizens of the faith' (Wilber 2000c, p.181).

The transition from the magic to mythic structure involved a transfer of power from the individual ego to the gods (Wilber 2000b). At the magic structure of consciousness, humans believe that their intentions can alter the world, through magic. However, as development continues, this belief begins to break down, confronted by conflicting factual evidence. It is gradually replaced by a belief in powerful gods and leaders that rule by right of physical dominance. There is little separation between gods and humans at this stage; powerful humans become gods and gods are physically close to the tribe. This stage exhibits the egocentric values discussed in Section 2.3.5. It is particularly well captured by Beck and Cowan (1996, p.41) in their description of the **power-gods** value structure that seeks to 'enforce power over self, others, and nature through exploitive independence'. For Wilber (2000b), this is a transitional magic-mythic stage, which remains egocentric and preconventional, but in which the allegiance to a particular tribe is beginning to break down.

As development continues, a pantheon of deities emerges; unlike the earlier power gods, these deities are quite distinct from humans. The differentiation of the biosphere and noosphere is stronger in the mythical structure, but still incomplete. With increasing differentiation of the noosphere, the collective capacity for abstraction increases. This capacity manifests in the emergence of a common pantheon of gods and goddesses that exist at a higher level of abstraction than the locally grounded spirits of magical tribes. Magical tribes recognised gods in the distinct

[58] Although, it is important to note that certain individuals will always develop to psychological waves beyond the cultural centre of gravity, and could therefore exhibit individual ecological awareness.

features of their geographic territory. These very specific deities recognised by individual tribes were amalgamated into general deities that could be shared by multiple tribes. This common belief system provided a basis for tribal integration.

The deities and associated myths of mythical cultures were (and are) understood in literal terms. At this developmental wave, myths are not metaphors but narratives of actual events, involving current or historical figures (Wilber 2000c). Inglehart (2000, pp.223-224) points out that these mythical and religious beliefs had an important function: 'In the uncertain world of subsistence societies, the need for absolute standards and a sense that an infallible higher power will ensure that things ultimately turn out well filled a major psychological need'.

Cognitively, the emphasis on traditional rules and absolute standards in mythical societies corresponds closely to the concrete-operational (or rule-based) stage of individual development identified by Piaget ([1929] 1973). The average stage of self-identify in mythical societies is conformist or sociocentric; the individual identifies with his or her society and takes on a specific role identity in that society (Wilber 2000c). Political structures are hierarchical, with deities and their earthly representatives at the top of the hierarchy. The average stage of moral development, embedded in legal norms, is conventional; the individual obeys the rules of their society without question (Wilber 2001). Values, in Beck and Cowan's (1996) scheme, are absolutist and religious. These waves of consciousness are observed today in children from the ages of about six or seven through to adolescence, and remain very influential in many adult individuals and cultures.

In mythical societies, the environment is not recognised as part of the state (Habermas 1979, p.112-113), and therefore is not awarded any special status. The degree of ecological destruction depends on the size and technological capacity of the society, and the system of traditional rules and myths that shape interactions with the environment. Typically, the relationship is one in which the state and its religion has dominion over people and nature. Compared to magical societies, mythical societies had greater population, access to animal energy, and a common purpose, allowing ecological destruction on a larger scale (see Ponting 1993). Historically, the period in which mythical societies dominated was characterised by widespread destruction of forests to clear space for agriculture and to fuel the conquests of the state.

The inherent limitations of the mythical structure are related to its insistence on one true religion, one true state and one true set of rules and beliefs. As mythical societies expanded, they encountered other states with very different religious beliefs and mythological systems. Through conquest, these states could be violently integrated into a common mythological structure, however this became increasingly difficult as the size of states grew. For sociocultural evolution to continue, a structure of consciousness was required that could recognise different belief systems. The rational structure of consciousness provided the basis for this recognition (Wilber 2000c).

The rational structure

Rationality, or reason, is the structure of consciousness associated with modernity and the European Enlightenment. The emergence of the rational structure of consciousness in human cultural groups is linked to the widespread emergence of formal operational cognition in individuals. The formal operational wave of cognitive development is characterised by 'the capacity not just to think, but to think about thinking' (Wilber 2000c, p.179). An individual applying formal operational cognition is able to reflect on his or her own thoughts and to develop critical distance from those thoughts. This distance opens up the possibility of different perspectives and prompts the individual to seek reasonable explanations for their thoughts and actions, rather than relying on the rules and norms of the mythological society for guidance (Wilber 2000c). Importantly, individuals applying formal operational cognition seek explanations that are universal and reasonable, such that another person following the argument should reach the same conclusion. This provided the foundation for the emergence of the modern scientific method.

Wilber (2000c, p.181) argues that, in the 'clash between myth and newly emerging reason, the traditional mythological structures were at first rationalized. That is, the old myths were propped up with rational reasons' and claims of universal truth. It was no longer enough to accept myths at face value; instead, 'rational religions' based on argumentative foundations emerged (Habermas 1979; Wilber 2000c). These rational religions included Christianity and Buddhism, both of which sought truth within, rather than in an external pantheon of deities (Wilber 2000c). Looking within to investigate the nature of the subject is characteristic of the rational structure of consciousness.

The rationalisation of traditional mythological structures created a transitional mythic-rational structure of consciousness that was associated with the emergence of the great historical empires: 'From the Incas to the Aryans, from the Aztecs to the Alexanders, from the Khans to the Romans' (Habermas 1979; Wilber 2000c, p.181). These empires sought, through brutal conquest, to make their particular mythology or religion universal. The quest for universality was typical of the rational structure of consciousness; the insistence that this universality would be founded on a specific set of beliefs was typical of the mythic structure of consciousness. The historical results are very evident, from the Crusades, to the conquest of the New World, to the Spanish Inquisition. So far, none of the mythic-rational empires has succeeded in their quest to conquer the entire world. However, mythic-rational structures are still a very important part of the modern geopolitical landscape; the Islamic and Christian fundamentalist rhetoric associated with the so-called War on Terror is typical of the mythic-rational structure.

As rational thought continued to unfold in individuals and cultures it paved the way for the development of the modern system of nation states, in which other states were granted formal recognition despite differences in their beliefs. This recognition of other perspectives is only possible with the development of formal operational cognition (Wilber 2000c, p.242). The functions of the church and the state were separated for the first time (Wilber 2000c, p.183), allowing political organisation to transcend commitment to any particular set of religious beliefs. Unhindered by religious dogma, scientists used formal operational cognition to seek universal reproducible truths, based on observation and reflection. This scientific method was wildly successful, underpinning the European Enlightenment, the Scientific Revolution, the Industrial Revolution and the explosive technological advances of the 20th century.

Whereas the average individual in a mythic society takes on a role identity, defined by society, the average individual in a rational society takes on a mature ego identity that is largely self-defined (Wilber 2000c, p.185). This use of the term **ego** is Freudian; it does not designate the adoption of an egocentric or self-centred perspective, but the emergence of a reasoning self that is capable of abstract thought and reflection on the society to which he or she belongs. That is, in a rational society, individuals are no longer compelled to take on a role ordained by the specific mythology to which they subscribe; they become autonomous agents, with a degree of control over their role in society. Further, as autonomous agents, individuals in a rational society become 'free and equal subjects of civil law, morally free subjects, and politically free subjects or democratic citizens of the state' (Wilber 2000c, p.389). This cultural change is reflected socially in a shift from hierarchical authoritarian political structures to increasingly democratic political structures.

The emergence of the rational autonomous agent allows a new moral and ethical sense to develop. The autonomous agent can apply reason to distance him or herself from the norms of society and 'consider what would be fair for all people and not merely one's own' (Wilber 2000c, p.235). This type of moral reasoning is postconventional, as it embodies a critique of the conventional morals embedded in rule-based societies. As this questioning continues, the individual can begin to develop a worldcentric moral sense, extending rights to all humans without exception. It is no coincidence, then, that rational societies were the first to outlaw slavery, the first to demand equal rights for women and the first to declare universal human rights.

With the widespread emergence of the rational structure of consciousness, the differentiation of noosphere and biosphere that began with the emergence of the magic structure finally reaches fruition. For the rational thinker, the mind is something that sets humans apart from the rest of the biosphere. Formal operational cognition, as noted above, allows thinkers to observe and operate on their own thought processes. This uniquely human ability to think, and be aware of that thinking, creates the modern rational self and opens up the new realm of the noosphere for conscious exploration. The role of reason in the creation of the separate self is famously captured by René Descartes' maxim, 'I think, therefore I am'.

Importantly, the emergence of formal operational cognition also provides the foundation for the development of ecological awareness. With the recognition of a human self separate from nature, the rational mind is no longer simply embedded in the biosphere; it can reflect, from a critical distance, on the complex web of ecological relationships that comprises the biosphere (Wilber 2000c, pp.241-242). Crucially, this means that formal operational is the cognitive stage at which ecological (or relational) thinking begins. At the formal operational stage, individuals begin to grasp how their actions might impact on other systems. This understanding deepens with the emergence of vision-logic discussed below.

The differentiation of human thought and culture (the noosphere) from body and nature (the biosphere) brought another significant benefit. As discussed in Section 2.4.4, it allowed the four ways of constructing reality represented by the quadrants to emerge. Before the emergence of rational thought and the differentiation of the noosphere, concepts of the self (psychological quadrant) and culture (cultural quadrant) as distinct from nature (systemic and behavioural quadrants) did not exist in Western societies, at least not on a widespread scale. Reason opened up the realms of the self and culture for investigation, providing the basis for Wilber's (2000c) quadrants.

Unfortunately, as discussed in Section 2.4.4, the story is not all positive. The modern differentiation of the noosphere and biosphere has tended to slide into dissociation 'with the capture of reason by its objectifying, monological and instrumental forms (a capture concomitant with industrialization)' (Wilber 2000c, p.491). By dissociation, Wilber means that the recognition of the noosphere and biosphere as distinct realms became a preference for one over the other, or a repression of one in favour of the other. There are two possible ways in which this dissociation can occur. The first is to take differentiation too far and absolutise the new abilities of the noosphere, effectively repressing or denying links to the biosphere. Wilber (2000c) labels followers of this approach the **Ego** camp. The second is to reject differentiation and seek to regress to the biosphere. Wilber (2000c) labels followers of this approach the **Eco** camp. The consequences of both approaches are devastating for the biosphere.

In the Ego camp, the emergent rational self loses sight of its links to the biosphere and absolutises the realm of the mind. The rational ego disengages from nature so that it can reflect on and manipulate the environment (Wilber 2000c, p.461). The Ego camp approaches 'the great interlocking order of nature with an objectifying and monological analysis…– a "dry and abstract" approach' (Wilber 2000c, p.491). In this camp, reason was '*captured* by empiric-analytic modes…which see *only* the Right-Hand dimensions and never the Left-Hand' (Wilber 2000c, p.464). At the same time, the Ego camp denied any notion of development in the noosphere, conceptualising the rational ego as universal and denying other waves of psychological and cultural development. The path pursued by the Ego camp would lead to the modern scientific and industrial project, which seeks to subdue nature and use it as a purely instrumental resource.

Meanwhile, the Eco camp 'aggressively rebelled' against the scientific-rational approach, 'preferring instead to find a unity with self and communion with nature via a more feeling-oriented awareness'

(Wilber 2000c, p.491). Where the Ego camp absolutised the noosphere, the Eco camp absolutised the biosphere. The Eco camp rebelled against the fractured worldview of the Ego camp that:

> …erroneously separates humans from, and often unnecessarily elevates humans above, the rest of the fabric of reality, a broken worldview that alienates men and women from the intricate web of patterns and relationships that constitute the very nature of life and Earth and cosmos (Wilber 2000c, p.12).

Their solution was to "get back to nature" and immerse themselves in the "web of life". The Romantic Movement that emerged in reaction to the Enlightenment (see Section 1.2.1) took this path. What the Romantics and others of the Eco camp failed to realise was that nature says nothing about freedom, good living conditions or the rights of the subject; these concerns only arise in the noosphere. Thus, the regression to nature meant abandonment of many of the positive aspects of rationality and the Enlightenment. Further, as I have outlined above, past societies that were closer to nature were no less guilty of ecological destruction than modern societies, although they lacked the means to inflict destruction on a modern scale. For Wilber (2000c, p.473), the regression to the biosphere is evident today in various ecophilosophies and 'new paradigm' movements that seek to idealise some past paradise as the solution to ecological problems, or that argue for an integration with nature while lacking any conception of the developmental processes required to achieve such an integration.

Thus, ironically, the first structure of consciousness capable of ecological thinking manifests either as a discourse that devalues the natural world, or a discourse that values the natural world but has no idea how this valuing came about. The Ego camp fails to recognise that the emergent abilities of the noosphere must be grounded in the rules of the biosphere. If the biosphere collapses, the noosphere will also collapse; in more familiar terms, economic and social systems are reliant on ecological systems. The Eco camp fails to recognise that the development of culture is a natural progression in human development and that the positive aspects of modern industrial society should not be discarded with the negative aspects. Further, it does not recognise that the cognitive and moral capacity to care about nature only arises through processes of subjective development.

Neither camp recognises the subjective quadrants, so neither can see that the solution to current ecological problems lies in processes of subjective development in the noosphere. As Wilber (2000c, pp.540-541) puts it:

> "Saving the biosphere" depends first and foremost on human beings reaching mutual understanding and unforced agreement as to common ends. And that intersubjective accord occurs only in the noosphere. Anything short of that noospheric accord *will continue to destroy the biosphere*.[59]

As a result of the twin dissociations of biosphere and noosphere, the rational structure of consciousness has contributed more than any other to the destruction of the natural world. The rise of rationality, then, is a classic example of the dialectic of progress. Rationality brings many positives, but carries with it new problems.

[59] Italics in original.

Beck and Cowan (1996) capture the values associated with the rational structure of consciousness, particularly the Ego camp, in their depiction of the individualistic-achiever self focused on material achievement, individual autonomy and strategic competition. Using the terminology of Section 2.3.5, this is the modern values stage. These modern values are prevalent in advanced industrial countries, closely aligned with neo-liberal ideas of free markets and competition. Indeed, the rational structure of consciousness is the most common cultural structure in advanced industrialised countries today. Wilber (2000b, p.198) calls the worldview at this stage 'rational formalism'; it is a reflective worldview, capable of taking multiple perspectives, but not yet fully aware of the dynamism, relativity and plurality of possible perspectives. The emergence of a more plural and relativist worldview signals the start of the transition to an integral structure of consciousness.

The integral structure

As formal operational cognition matures and worldcentric morality deepens, a worldview called pluralistic relativism emerges. This worldview is associated with the transition between the rational structure of consciousness and an integral structure of consciousness, described by Gebser ([1949] 1985) and Wilber (2000c). Pluralistic relativism emerges as the reality of difference confronts the Ego camp's assumption of universality. From the perspective of pluralistic relativism, there are multiple contexts, perspectives and histories instead of universal structures. Pluralistic relativism is a dynamic worldview that often coincides with greater ecological awareness and cultural sensitivity. Beck and Cowan (1996) describe the self at this stage as the relativistic or sensitive self, concerned with sharing and participating on an equal basis. Pluralistic relativism is particularly evident today in academia, and in much postmodern thought, which is why I labelled it the postmodern value stage in Section 2.3.5.

Inglehart (2000, p.222) outlines some of the characteristics of postmodern value structures revealed by empirical research:

> Postmodern values emphasize self-expression instead of deference to authority and are tolerant of other groups and even regard exotic things and cultural diversity as stimulating and interesting, not threatening…Postmodern values give priority to environmental protection and cultural issues, even when these goals conflict with maximizing economic growth.

For Inglehart, postmodern values also place less emphasis on material wealth and more on broader conceptions of quality of life.

Cognitively, the emergence of pluralistic relativism marks the transition from formal operational cognition to a type of cognition that Wilber (2000c, pp.190-191) calls **vision-logic**:

> As rationality continues its quest for a truly universal or global or planetary outlook, noncoercive in nature, it eventually gives way to a type of cognition I call vision-logic or network-logic. Where [pluralistic] rationality gives all possible perspectives, vision-logic adds them up into a totality…[It] can hold in mind contradictions, it can unify opposites, it is dialectical and nonlinear, and it weaves together what otherwise appear to be incompatible notions…negated in their partiality but preserved in their positive contributions.

Vision-logic is central to the postmodern insights into the social construction of reality and the plurality of perspectives. As discussed in Section 2.2.1, postmodernists objected to the universalising tendency of rationality (particularly as applied by the Ego camp) because it imposes interpretations on others that those others might not agree with. While rationality is capable of taking different perspectives, it has historically shown a tendency to privilege particular perspectives and ignore the subjective aspects of reality. Vision-logic, on the other hand, is aperspectival – it adds up the totality of perspectives, 'and therefore privileges no perspective as final' (Wilber 2000c, p.193). Postmodernism draws on vision-logic in its emphasis of subjectivity, perspective and context.

Of course, like rationality, vision-logic has healthy and unhealthy forms, both of which are clearly on display in postmodernism. For example, it is possible to become completely lost in the boundless perspectives that are revealed by vision-logic. Starting from the important insight that no perspective is final, many postmodernists have gone on to argue that no perspective has an advantage over any other. I outlined some of the problems with this position in Chapter 2, particularly the practical problem of how to make policy decisions without marginalising any perspectives if all perspectives are equally valid. In addition, it should be clear from the discussion in this section that the historical development of cultural perspectives has been towards greater inclusion and, as a result, later structures have important advantages over earlier structures.

As vision-logic matures, it underpins an integral structure of consciousness that integrates multiple perspectives by relating them developmentally. The integral structure builds on the positive aspects of rationality. As noted above, rationality gives rise to autonomous agents with legal and moral freedom. At first, these freedoms are conferred on citizens of a particular nation-state. However, as worldcentric morality develops and deepens it becomes increasingly clear, for individuals applying the integral structure of consciousness, that these freedoms are appropriately conferred on all people as 'world citizens' (Wilber 2000c, p.191). Indeed, the integral structure of consciousness supports a morality that extends rights to all living things.

The emerging integral structure of consciousness is also a response to changes in the systemic quadrant. Global environmental problems, global economic systems and transnational conflicts (such as the War on Terrorism) all challenge the continuing relevance of the nation-state as the primary form of socio-political organisation (e.g. Singer 2002; Wilber 2000c, pp.204-205). Global issues demand global responses and the role of nation-states in mediating these responses remains unclear. For Wilber (2000c, p.192): 'The modern nation-state, founded upon initial rationality, has run into its own internal contradictions or limitations, and can only be released by a vision-logic/planetary transformation'.

The planetary institutions that may eventually transcend nation-states are beginning to emerge, led by developments in the systemic quadrant, such as the globalisation of economic exchange and communication networks. There is some evidence of corresponding developments in the subjective quadrant, such as the emergence of global civil society (e.g. Keane 2003) and transnational democracy (e.g. Dryzek 2000). However, despite tentative global developments, the integral structure of consciousness remains rare and has little apparent influence on national or international environmental policy. Nevertheless, the integral structure of consciousness is not merely a normative ideal. Strong evidence for the existence of such a structure comes from psychological studies of individuals that have developed beyond formal operational cognition (Wilber 2000c, p.266).

Vision-logic is characterised by a deepening of the trends that began with the emergence of rationality. For example, 'where rationality began the *worldcentric* orientation of universal pluralism, vision-logic brings it to a mature fruition by demanding not just legal and moral freedom, but legal and moral and political freedom' (Wilber 2000c, pp.267-268). More generally, the integral structure of consciousness continues the development of postconventional and worldcentric morality. Beck and Cowan (1996) identify two distinct value structures associated with the integral structure of consciousness. The first to emerge is the systematic-integrative self in the early stages of vision-logic. This self recognises the world as a vast array of nested systems, with both objective and subjective components. The second to emerge, as vision-logic continues to develop, is the global-holistic self. This self integrates feeling and knowledge and understands reality in truly global terms. In Section 2.3.5, for convenience, I combined these two value structures as the integral value structure.

The crucial characteristic of vision-logic, for environmental discourse, is its ability 'to differentiate from rationality (look at it, operate upon it)' (Wilber 2000c, p.268). Vision-logic can see reason as a quality that develops out of matter and life, and can therefore integrate the physiosphere, biosphere and noosphere, using a developmental perspective (Wilber 2000c, p.268). Neither the biosphere, nor the noosphere, is absolutised. Instead, vision-logic accepts the reality of biospheric laws, while recognising that care for the biosphere only emerges through subjective developments in the noosphere. In other words, the integral structure of consciousness recognises the existence of waves of development, in all quadrants, and seeks to weave these perspectives together through an AQAL approach. The integral structure of consciousness is therefore profoundly ecological, while at the same time being aware that many individuals do not share this ecological orientation. The nature of environmental discourse at this wave of development is still emerging; this thesis is intended as a contribution to that emergence.

I will return to the characteristics of the integral structure of consciousness, and the types of objective institutions that can facilitate its emergence, in Chapter 8. In the next section, I will use the integral understanding of environmental discourse developed in this section to reinterpret the various environmental discourses identified by Dryzek (1997) from an integral perspective.

7.3 An integral interpretation of Dryzek's environmental discourses

In *The Politics of the Earth*, Dryzek (1997) develops a useful characterisation of the main discourses through which people approach environmental issues. I introduced these discourses in Section 4.9.1. Dryzek starts by identifying a dominant discourse that is fundamentally committed to economic growth, self-interest and market-based competition and assumes human dominance over the environment. Dryzek labels this discourse **industrialism**. In opposition to this dominant discourse, Dryzek identifies four categories of environmental discourse, as shown in Table 7.1. The discourses are classified according to two characteristics: whether their departure from industrialism is reformist or radical, and whether they take a prosaic or imaginative approach. The former distinction is between discourses that seek incremental change and those that seek revolutionary change. The latter distinction is between discourses that take the existing political economy as given and those that imaginatively redefine political-economic structures.

	Reformist	**Radical**
Prosaic	Problem Solving	Survivalism
Imaginative	Sustainability	Green Radicalism

Table 7.1: Dryzek's (1997) classification of environmental discourses.

Dryzek identifies the basic entities recognised or constructed by each discourse, their assumptions about natural relationships, the agents and motives recognised by each discourse and their key metaphors and rhetorical devices. His application of discourse analysis draws on 'twenty years of working and teaching in the environmental field' (Dryzek 1997, p.9) and analysis of literature. In the sections below, I will apply meta-discourse analysis to identify the quadrants, waves and streams associated with each discourse, drawing on Dryzek's own discourse descriptions and my own interpretations.

I will also seek to identify developmental relationships between the various discourses. Dryzek (1997, p.18) argues that: 'With time, environmental discourses develop, crystallize, bifurcate, and (perhaps, someday) dissolve'. That is, he is open to the idea that discourses develop over time. Indeed, Dryzek (1997, p.5) states a belief in progress, although he does not go so far as to argue that the history of environmental affairs is one of continual progress. Dryzek points out some of the developmental links between the discourses he identifies, but he primarily concentrates on discussing the characteristics of each discourse. Therefore, one of my tasks in the sections that follow is to identify and map any apparent developmental relationships between the discourses.

Finally, I am particularly interested in how different discourses frame energy and climate policy issues. Dryzek does not specifically address this issue, however I have drawn some conclusions based on his descriptions of each discourse. I will outline my interpretations of the orientation of each discourse towards energy consumption and climate change response in the sections below.

7.3.1 The Promethean discourse

As noted above, Dryzek argues that the dominant discourse of industrialism is the origin of all the environmental discourses listed in Table 7.1. For most of its history, industrialism was an unarticulated discourse; its assumptions were implicit and largely unconsidered. However, in the face of challenges from other discourses (particularly survivalism), proponents of industrialism began to articulate and make explicit their assumptions and arguments. Dryzek labels the articulated version of industrialism as **Promethean** discourse.

In Greek mythology, Prometheus was a Titan who stole fire from the gods and delivered it to humans, sparking human technological development. Prometheus symbolises the human capacity for problem solving and technological development. According to Dryzek (1997, p.45), 'Prometheans have unlimited confidence in the ability of humans and their technologies to overcome any problems presented to them'. An alternative label for the discourse is **cornucopian**, a reference to underlying assumptions of 'unlimited natural resources, unlimited ability of natural systems to absorb pollutants, and unlimited corrective capacity in natural systems' (Dryzek 1997, p.45). Promethean discourse is evident in 'our dominant institutions: a capitalist economy geared to perpetual economic growth, and a political system whose main task is to facilitate the conditions for that growth' (Dryzek 1997, p.53). As discussed in Section 5.3.1, the ideological commitment of Prometheans to economic growth is clearly evident in Australian energy and greenhouse policy decisions. It is also evident in the economic interpretations of sustainable development I discussed in Section 1.4.2, which deny ecological limits.

Dryzek describes five characteristics of Promethean discourse that immediately link it to the Ego camp described in Section 7.2.3. First, Prometheans deny the existence of environmental limits; indeed, nature does not exist as 'anything more than a store of matter and energy' (Dryzek 1997, p.49). This instrumental approach is typical of the Ego camp, which objectifies and manipulates nature. Second, the Promethean discourse employs mechanistic metaphors to describe the world (Dryzek 1997, p.52). For members of the Ego camp too, nature is 'the great and grinding system' (Wilber 2000c, p.443), mechanistic to the core. Third, the Promethean discourse assumes that human minds are at the top of a natural hierarchy that dominates nature (Dryzek 1997, p.50). For the Ego camp, humans are placed above nature due to their unique noospheric abilities. Fourth, Dryzek (1997, p.50) asserts that 'the Promethean discourse comes close to denying the very existence of nature'. Similarly, Wilber (2000c, p.461) argues that the Ego camp represses the biosphere. Finally, Promethean discourse emphasises competition between economic actors as a way of stimulating innovation and is committed to the market 'as the best means for organizing economy and society' and delivering a 'bright environmental future' (Dryzek 1997, p.51). The approach of the Ego camp to environmental problems is that 'the free market will save us' (Wilber 2000c, p.173).

It is clear that the two authors are describing very similar discourses. I therefore contend that Promethean discourse is the inheritor of the Enlightenment's tendency to absolutise the rational ego. To advocate ongoing economic and material growth despite the ecological evidence that such growth is impossible is a clear case of absolutising the noosphere and denying the biosphere. Promethean discourse employs an instrumental version of formal operational cognition that is only aware of the objective quadrants and fails to see the subjective quadrants. At the same time it absolutises the developmental waves that make up the rational ego and denies the authenticity of any pre-rational or post-rational developments.

Promethean discourse theoretically allows all people to participate in society, but only as economic actors in pursuit of wealth; it assumes that the desire for material wealth and abundance is universal. Morally, the discourse is sociocentric and conventional, as evidenced by its constant appeals to the national interest as opposed to wider human interests or those of other species. Australia's position on the Kyoto Protocol, discussed in Section 5.2.2, is one example of the prioritisation of the national interest above broader interests. Its values are the modern values discussed in Section 2.3.5, i.e. market-oriented, rational, individualistic and materialistic.

My interpretation of Promethean discourse is that it is committed to growth in energy consumption, explicitly or implicitly, as a way of facilitating economic growth. Energy is a crucial input for industry and production, as well as being a source of export wealth. Promethean discourse is essentially unconcerned with the environmental impacts of energy consumption, including climate change, except to the extent that these impacts might limit the availability of material inputs to the economy. If forced to contemplate climate change response, Prometheans will favour market instruments, such as emissions trading.

7.3.2 Survivalism

In Section 1.4.2, I discussed the limits to growth debate as it has played out in the sustainable development literature. The discourse of **survivalism** strongly emphasises ecological limits to growth. One of its defining works is *The Limits to Growth* (Meadows et al 1972). The basic survivalist storyline is that 'human demands on the carrying capacity of ecosystems threaten to explode out of control, and draconian action needs to be taken in order to curb these demands' and avoid an apocalyptic collapse (Dryzek 1997, p.34). For the survivalist, the Earth has a finite capacity to produce renewable resources and assimilate wastes, and a finite stock of non-renewable resources. Survivalists therefore seek a steady state economy that operates within the ecological limits of 'Spaceship Earth'; the image of Spaceship Earth is a key metaphor in survivalist discourse (Dryzek 1997, p.36).

The survivalist discourse is concerned by the aggregate impact of human populations on the environment. It sees a hierarchy as the natural way to organise human affairs, with expert elites at the top of the hierarchy. It therefore seeks to develop global hierarchical institutions, coordinated by elites, to address global environmental problems. Dryzek (1997, p.14) characterises the survivalist discourse as radical in its demand for dramatic redistribution of power and revision of societal objectives, but prosaic in its reliance on familiar political institutions.

A striking feature of survivalism is an uneven pattern of development across streams. Cognitively, its analysis of the complex interactions between ecological systems and human social systems is characteristic of the late stages of rationality and the early stages of vision-logic or network thinking. Systematic thinking of this kind only emerges in the late stages of formal operational cognition, and the ability to conceptualise 'systems of systems' only emerges in the early stages of vision-logic (Wilber 2000b, p.201). The survivalist understanding of global interacting systems and use of global metaphors indicates application of vision-logic.

However, the solutions to ecological problems proposed by survivalists reveal a value position that is more characteristic of the mythical structure of consciousness described in Section 7.2.3 and the mythic, absolutist values discussed in Section 2.3.5. Survivalists argue for 'tried-and-tested practices, especially strong governmental control' (Dryzek 1997, p.21). The form of this control is 'centralized and authoritarian' (p.31), based on an argument that 'freedom, including the freedom to breed, needs to be curtailed' (pp.31-32). Here, a retreat from the freedoms won by rationality to the security and control of rule-based systems is very evident. This is a retreat from a worldcentric perspective to, at best, an anthropocentric perspective. In some cases, survivalist treatises go so far as to imply abandonment of the developing world (Dryzek 1997, p.32), which is a retreat to a sociocentric perspective.

This retreat does not constitute a return to traditional religious beliefs. Instead, scientific elites replace the priests and kings that once ruled mythic societies. As Dryzek (1997, p.32) notes, 'the discourse of limits and survival places great emphasis on expertise, be it that of systems modellers, population biologists, or ecologists'. In survivalist discourse, it is either 'assumed that there are elites who are responsible for the world', or a similar position is reached through reasoned argument (Dryzek 1997, p.35). The expert elites exist at the top of a hierarchical government structure that curtails individual freedoms in the interest of reducing ecological impact.

Survivalists, then, have developed a valid insight into the ecological problems posed by industrial society, but attempted to solve these problems through regression to a hierarchical social structure, ruled by an expert elite. Like the Prometheans, survivalists are guilty of ignoring the subjective quadrants. They are also guilty of absolutising a particular wave of development – in this case, a mythic role identity instead of the rational ego. The coexistence of a relatively advanced cognitive wave with mythic regression is an uneasy one:

> If the computer represented the rationalistic, calculating side of survivalist discourse, it co-exists uneasily with quasi-religious images of doom and redemption. The earthly paradise of a stationary state is attainable – but only if we recognize our sin, and change our ways quite thoroughly (Dryzek 1997, p.36).

Dryzek (1997, p.43) finds that survivalism has had little concrete impact on political institutions and, indeed, its relevance has continued to fade since Dryzek's (1997) analysis. Given the internal developmental conflict within the discourse, this finding is unsurprising. There are still elements of survivalist discourse in warnings against excessive energy consumption and predictions of the serious threat that climate change poses to human civilisation. However, fields like ecological economics, which Dryzek identifies with survivalism, have abandoned most of the regressive elements of survivalism and, in some cases, have attempted more developmental (e.g. Matutinovic 2001; Ring 1997) or even spiritual approaches (e.g. Hamilton 2002). Where survivalists would seek reductions in energy consumption and GHG emissions through strong central regulation, most environmentalists have turned to more cooperative and participatory solutions.

7.3.3 Problem solving discourses

Dryzek (1997) identifies three problem solving discourses: administrative rationalism, democratic pragmatism, and economic rationalism. These discourses 'recognize the existence of ecological problems, but treat them as tractable within the basic framework of the political economy of industrial society' (Dryzek 1997, p.61). That is, they recognise the environmental problems of industrialism, but they do not share the radical rejection of economic growth that characterises survivalism. Each of the problem solving discourses recognises climate change as an important issue and seeks to reform political and economic institutions to better address this issue. All three discourses are underpinned by rational structures, however they each emphasise different developmental waves and streams.

Administrative rationalism

Administrative rationalism seeks to solve environmental problems by drawing on scientific expertise within an administrative bureaucracy:

> Administrative rationalism may be defined as the problem-solving discourse which emphasizes the role of the expert rather than the citizen or producer/consumer in social problem solving, and which stresses social relationships of hierarchy rather than equality or competition (Dryzek 1997, p.63).

The discourse is typified by professional resource management bureaucracies, pollution control agencies, regulatory policy instruments, environmental impact assessment, expert advisory commissions and various rationalistic policy analysis techniques (e.g. cost benefit analysis and risk analysis) (Dryzek 1997). The emphasis is on regulation by a monolithic government, made up of experts and managers, with clearly defined roles and positions in the bureaucracy. Nature is 'subordinated to human problem-solving' (Dryzek 1997, p.74) and 'the public interest is conceptualised in unitary terms' (Dryzek 1997, pp.74-75).

There are echoes in this discourse of the survivalist approach, particularly in the emphasis on hierarchies led by scientific experts. However, this discourse remains completely committed to scientific rationality; there are no quasi-religious overtones or metaphors. In addition, the discourse does not question liberal capitalism and its commitment to economic growth. The discourse lacks the radical tones of survivalism.

One of the defining features of administrative rationalism is the assumption that a reductionist, bureaucratic approach is the most rational way to solve environmental problems. This approach links the discourse to the early stages of formal operational cognition and the worldview of **rational formalism**, which employs rational cognition in a static form that seeks universal solutions (Wilber 2000b, p.198). In this case, the bureaucracy is put forward as the universal solution to environmental problems. Instead of applying systems thinking, administrative rationalism seeks to break a problem down into its component parts and allocate those parts to appropriate experts. However, as Dryzek (1997, p.79) points out, the complex nature of environmental problems eventually defeats such approaches, leading to implementation deficits (i.e. a disparity between policy objectives and reality) and problem displacement (i.e. the transferral of the problem being addressed to another location or medium). Administrative rationalist discourse, lacking a systems perspective, fails to recognise that 'relevant human knowledge is dispersed and fragmentary' (Dryzek 1997, p.80). It defines problems in immediate, local terms and cannot cope with the long-term, systemic, global problems recognised by survivalism.

The emphasis on hierarchy, expertise, regulation and punishment (e.g. fines for pollution) is more consistent with absolutist (mythic) values than with rationalism and individualistic (modern) values. Nevertheless, the discourse claims a strong commitment to scientific rationality. I believe that the commitment to rationality is genuine, but that rationality is interpreted in terms of the particular social institutions with which the discourse is familiar, namely hierarchical, bureaucratic structures. Dryzek (1997, p.74) notes that 'the discourse has a strong conception of the nature of government', and it seems that conception is underpinned by mythic values. This conception is evident in the hierarchical and controlling metaphors employed by the discourse:

> If there is a metaphor that characterizes the discourse, it is that of a unitary and omniscient administrative mind. This is like the human mind, only collective and embodied in the administrative state. Just as the human mind controls the body, so the administrative mind controls the state (Dryzek 1997, p.75).

Administrative rationalism, then, is characterised by early formal operational cognition, but with a continuing (albeit weakened) commitment to the authoritarian political structures and absolutist values that characterise mythic, rule-based societies. Underlining the mismatch between cognition and values in the discourse, Dryzek (1997) notes that 'it is increasingly hard to proclaim one's faith in bureaucracy and administrative rationalism'. The adherence of administrative rationalism to liberal capitalism creates an internal tension between the economic and political developmental lines; rational markets sit uneasily with absolutist hierarchies. This often manifests as an external conflict between administrative rationalists and economic rationalists, identified by Dryzek (1997, p.83).

Like most of the discourses discussed here, administrative rationalism is trapped in flatland, ignoring the subjective quadrants. While it performs quite well in solving environmental problems when they first emerge, it is hampered by the lack of a systems perspective and a distributed approach to problem solving, and soon comes across problems that it cannot easily handle. As Dryzek (1997, p.80) puts it: 'More complex, invisible, and contentious issues like acid rain eventually come to the fore, but prove much harder to conceptualize, to even define the problem at hand, and to craft solutions'. Similarly, administrative rationalism performs poorly when faced with a global problem like climate change that demands cooperative rather than bureaucratic solutions.

Democratic pragmatism

Democratic pragmatism is one of the responses to the failure of administrative rationalism to adequately deal with complex environmental problems. Democratic pragmatism 'may be characterized in terms of interactive problem solving within the basic institutional structure of liberal capitalist democracy' (Dryzek 1997, p.85). That is, 'government is carried out by liberal democracy, not the administrative state' (Dryzek 1997, p.95). This discourse is pragmatic in both its 'practical, realistic orientation to the world' and its commitment to 'learning through experimentation' (Dryzek 1997, p.85). It is 'the version of democracy which dominates today's world' (p.84), embodied in traditional approaches to public consultation, alternative dispute resolution, policy development through dialogue, public inquiries and right-to-know legislation (Dryzek 1997). I discussed elements of this discourse in Section 4.11.2 (on liberal democracy) and the sections of Chapter 5 on consultative processes.

Cognitively, democratic pragmatism appears to occupy the transitional area between formal operational cognition and vision-logic. Democratic pragmatists are more aware of system complexity and distributed relationships than administrative rationalists. As a result, democratic pragmatism has a greater capacity to address the complex environmental problems that eventually defeat administrative rationalism. Democratic pragmatism is based on the argument that:

> The most rational approach to problem solving, in life as in science, involves learning through experimentation. For problems of any degree of complexity, the relevant knowledge cannot be

> centralized in the hands of any individual or any administrative state structure. Thus problem solving should be a flexible process involving many voices, and cooperation across a plurality of perspectives (Dryzek 1997, p.85).

As well as providing a superior approach to problem solving, democratic pragmatism is driven by 'a felt need to secure legitimacy for decisions by involving a broader public' (Dryzek 1997, p.86). As rational thought develops, it becomes more evident that all individuals, as autonomous agents, have the right to participate in societal decision-making. Democratic pragmatism gives all citizens and other actors the formal right to participate. It more closely aligns the social institutions of government with the rights revealed by formal operational cognition, reducing some of the tension evident in administrative rationalism. Its interpretation of rationality is broader than that of administrative rationalism and economic rationalism (discussed below).

This emphasis on plurality links democratic pragmatism with the worldview of pluralistic relativism, discussed in Section 7.2.3, and with postmodern values. Democratic pragmatists seek participation that is representative of the plurality of perspectives (Dryzek 1997, p.85). In practice, as discussed in Section 5.3.6, this desire is often satisfied through stakeholder or interest group participation, rather than widespread citizen participation. Further, the ideals of democratic pragmatists are rarely achieved in practice due to constraints posed by existing institutions (e.g. market economies) and an uneven distribution of political power (Dryzek 1997) that favours business interests and modern values. As a result of these constraints, particularly the uneven distribution of power across plural value structures, democratic pragmatism can work against ecological values and the public interest.

I believe democratic pragmatism constitutes an accommodation between emerging pluralistic or postmodern values and existing social institutions and relationships that are more consistent with modern values. Pluralist democracy is practiced within the constraints of the liberal capitalist commitment to material growth. The discourse can be characterised as applying late formal operational to early vision-logic cognition (systems thinking), in the context of rational social institutions, at the point of transition from modern to postmodern values. This transition is particularly evident in the uneasy 'mix of competition and cooperation' (Dryzek 1997, p.96) and the tension between material interests and the public interest that characterise the discourse.

A final point to note is that this discourse emphasises the political stream in the social quadrant, rather than, say, the economic stream. This emphasis, and the tensions noted above, brings the discourse into conflict with economic rationalists. However, the discourse seeks to accommodate economic rationalists as one of the plurality of perspectives that exist in society.

Economic rationalism

The third of the problem solving discourses is **economic rationalism**. Economic rationalists generally share the Promethean commitment to market principles, but 'recognize that, whatever the case in other areas, markets in environmental goods do not always exist, and so often need to be created and managed' (Dryzek 1997, p.102). Economic rationalism is committed to 'the intelligent deployment of market mechanisms to achieve public ends' (Dryzek 1997, p.102). That is, it uses market instruments to solve environmental problems, including climate change. The economic rationalist approach often emphasises privatisation of environmental resources via allocation of property rights. However, economic rationalists will settle for 'government-managed markets, and failing that quasi-market incentives' (Dryzek 1997, p.108), including tradeable emission rights and ecological taxes. On energy and greenhouse issues, economic rationalists argue for deregulation of the energy sector and inclusion of environmental externalities so that markets can identify the optimal level of energy consumption and climate change response for people and the environment.

From an integral perspective, there is very little difference between the Promethean and economic rationalist discourses identified by Dryzek. Both correspond closely to Wilber's Ego camp, applying an instrumental form of rationality to an assumed objective world. The main point of departure is the recognition, by economic rationalists, that markets may need to be modified to deal adequately with environmental problems and achieve public ends. This is essentially the distinction between a conventional and postconventional perspective. The Promethean discourse is conventional in its assumption that existing institutions are adequate and unquestionable. The economic rationalist discourse can reflect on institutions and identify opportunities for modification. The ability to take a postconventional cognitive perspective indicates a maturation of formal operational cognition relative to Promethean discourse.

In most other respects, economic rationalism is consistent with Promethean discourse. Economic rationalists see the world as comprising individual and collective economic actors (producers and consumers) competing to maximise their material self-interest. The values of economic rationalists are those of the individualistic achiever self identified by Beck and Cowan (1996). There are no citizens in economic rationalist discourse (Dryzek 1997, p.112) and no cooperation, indicating that pluralistic or postmodern values have not yet emerged. Further, 'environments do not exist in any strong sense' (Dryzek 1997, p.112). For economic rationalists, nature exists only 'to provide inputs to the socio-economic machine, to satisfy human wants and needs' (Dryzek 1997, p.113). Economic rationalism shares the mechanistic metaphors of the Promethean discourse, but recognises that the machine is not working perfectly and that environmental resources may be limited (Dryzek 1997). Despite this recognition, nature remains a flatland mechanism, viewed objectively by the disembodied rational ego. The subjective quadrants are unperceived.

Despite its rhetorical strength in liberal democracies, Dryzek argues that economic rationalism has had much less impact on policy than administrative rationalism and democratic pragmatism. In part, this is due to the economic rationalist tendency to absolutise economic development and instrumental forms of rationality; economic rationalists are blind to the existence of non-economic motivations for human behaviour, different forms of rationality and different values. Dryzek (1997, p.118) provides an excellent description of the failure of economic rationalism to account for pluralistic values:

> In short, no matter how attractive economic prescriptions may be in instrumental terms, even to committed environmentalists, they help constitute a discourse, and a world, which those according higher priority to citizenship, democratic, and ecological values find unattractive.

Drawing on my literature review in Chapter 3, I believe that the many institutional barriers to market instruments also limit the impact of economic rationalism.

7.3.4 Sustainability discourses

Dryzek (1997) identifies two sustainability discourses: sustainable development and ecological modernisation. Both 'remain reformist in their orientation to industrialism, but are more imaginative in seeking ways to dissolve familiar dilemmas and impasses' (Dryzek 1997, p.119). Dryzek (1997, p.125) points out, correctly I believe, that 'sustainable development is emerging as the main game (though not quite the only game) when it comes to environmental affairs'. Since Dryzek wrote those words in 1997, the sustainability discourses have, if anything, become even more dominant as a way of framing environmental issues. The distinguishing feature of the sustainability discourses, compared to those already considered, is the attempt to develop concrete institutions that reflect worldcentric, relativistic, cooperative values.

Sustainable development

Sustainable development is 'an integrating discourse' that seeks to 'combine ecological protection, economic growth, social justice, and intergenerational equity, not just locally and immediately, but globally and in perpetuity' (Dryzek 1997, p.121). However, as Dryzek points out, this goal has not been achieved anywhere in practice; it is achieved only at the level of discourse and rhetoric. I argued in Chapter 1 that definitions of sustainable development depend fundamentally on the values of the definer. Consequently, I am reluctant to discuss sustainable development as a unified discourse. Rather, I see the discourse of sustainable development as an arena where other discourses meet and contestation is played out. Dryzek (1997, p.124) is aware of this contested element of sustainable development, noting that the proliferation of definitions of sustainable development:

> …is also an issue of different interests with different substantive concerns trying to stake their claims in the sustainable development territory. For if sustainable development is indeed emerging as a dominant discourse, astute actors recognize that the terms of this discourse should be cast in terms favorable to them.

Nevertheless, putting aside the differences that characterise sustainable development discourse, it is possible to identify some common understandings and value commitments underlying the discourse. First, sustainable development stresses 'nested systems, ranging from the global to the local. The systems in question are both social and biological. Natural systems are not something separate from humanity' (Dryzek 1997, p.129). I have already discussed, in Section 1.4.3, the systems perspective that underpins most conceptual approaches to sustainable development. The recognition of nested systems, or systems of systems, is characteristic of the early stages of vision-logic cognition (Wilber 2000b). That is, sustainable development discourse has a relatively sophisticated understanding of the relationships between economic, ecological and social systems.

Second, sustainable development seeks to embed the insights of a systems perspective in the institutions of the social quadrant. As Dryzek (1997, p.130) puts it:

> The reorientation in problem solving that sustainable development prescribes may require shifts in power between different levels in order to more effectively meet the challenge of sustainability. The frequent appeals to coordinated international action and grassroots participation suggest that these shifts would be away from the nation-state as presently constituted to both higher (transnational) and lower (local) levels of political organization.

In other words, sustainable development, in its more advanced forms, seeks to develop concrete institutions that go beyond the rational nation-state to embody integration across levels and contexts. In particular, 'sustainable development is a discourse of and for global civil society' (Dryzek 1997, p.131). As noted in Section 7.2.3, vision-logic cognition supports planetary institutions of this type.

According to Dryzek (1997, p.125), sustainable development emphasises 'coordinated collective efforts to achieve goals'. He argues that the discourse regards cooperation and partnership as the appropriate approaches to environmental problems, rather than competition, and is committed to citizen participation, personal development and growth. Further, Dryzek (1997, p.131) argues that sustainable development discourse 'is consistent with notions of personal human growth that stress education and growing awareness…The image is of an increasingly sensitive, caring, and intelligent human being'. Here, I would argue that Dryzek is particularly emphasising the entry of pluralistic and communitarian values, or Beck and Cowan's (1996) sensitive self, into sustainable development discourse. While I agree that many who participate in sustainable development are acting from pluralistic values, I have already pointed out that sustainable development is a hotly contested discourse, engaged by people across the whole spectrum of values. There are individualistic and material interpretations of sustainable development, wedded to the ideal of economic growth and modern values. Equally, there are interpretations of sustainable development committed to integral values, including my own approach in this thesis. A key characteristic of sustainable development discourse is its contestation over values; there are certainly no particular values that define the discourse.

For mine, sustainable development is a discourse founded on the application of the early stages of vision-logic and *dominated* by pluralistic values, while admitting (sometimes reluctantly) other value structures. Sustainable development discourse seeks to modify the institutions of the systemic quadrant to embody a systems perspective and, often, to embed cooperative or pluralistic processes. So far, sustainable development discourse has tended to concentrate on objective changes to technological, economic and political institutions. However, despite many small success stories, most social institutions in developed countries remain more consistent with rational cognition and modern values than vision-logic or pluralistic values. Faced with the slow pace of objective change, the sustainable development discourse is gradually recognising the crucial role of subjective development. This change is evident in an increasing emphasis on the social dimension of sustainable development, broadly defined to include psychology and culture, since Dryzek published his analysis of sustainable development discourse. I outlined some of the emerging subjective approaches to sustainable development in Section 1.4.2.

Ecological modernisation

Ecological modernisation is a much more coherent discourse than sustainable development discourse, and Dryzek (1997, p.141) argues that it has developed a stronger and more precise case for the profitability of environmental conservation:

> Ecological modernization refers to a restructuring of the capitalist political economy along more environmentally sound lines. Environmental degradation is seen as a structural problem which can only be dealt with by attending to how the economy is organized…Conscious and coordinated intervention is needed to bring the required changes about.

Ecological modernisation seeks improvements in energy and material efficiency, through redesign of technological and economic systems, to achieve environmental and economic benefits. Bulkeley (2000b) identifies the no-regrets approach to greenhouse policy in Australia, discussed in Section 5.2.1, as an ecologically modern approach.

Ecological modernisation 'is a systems approach which takes seriously the complex pathways by which consumption, production, resource depletion, and pollution are interrelated' (Dryzek 1997, p.144). However, ecological modernisation denies 'any notion that nature might spring surprises on us, defy human management, have its own intrinsic value, [or] its own open-ended developmental pathways' (p.144). In other words, the type of systems thinking applied by ecological modernists is less relational than that applied by the sustainable development discourse. It recognises the dependence of human systems on ecological systems but fails to grasp that the complex network of relationships and feedback mechanisms between and within these systems creates unmanageable unpredictability and surprise. As Dryzek (1997, p.144) puts it, ecological modernisation 'views natural systems in limited terms, as mere adjuncts to the human economy'. This view of systems is characteristic of the transition from formal operational cognition to vision-logic (Wilber 2000b, p.201).

A defining feature of ecological modernisation is the active cooperation of businesses, governments, environmentalists and scientists in the design and implementation of policy through consensus building. Ecological modernisation is committed to 'foresight, attacking problems at their origins, holism, greater valuation of scarce nature', the precautionary principle, and the decoupling of economic growth from growth in consumption and waste (Dryzek 1997, p.143). These commitments indicate that the discourse occupies the point of transition between materialistic modern values and pluralistic postmodern values. Specifically, the commitment to economic growth is typical of modern values, whereas the commitments to cooperation, consensus, holism and precaution (i.e. transcending scientific rationality) are more typical of postmodern values. It would be fair to say that the discourse is closer, on average, to a postmodern value commitment.

Ecological modernisation seeks to change political institutions although, unlike sustainable development discourse, it does not go so far as to de-emphasise the state, instead emphasising partnership within the state. Here, the discourse again demonstrates its commitment to values at the transition from modern (committed to the rational state) to postmodern (committed to partnerships). Ecological modernisation can point to more concrete achievements than sustainable development, perhaps because its qualified acceptance of modern values poses less of a challenge to the dominant Promethean discourse. The discourse has thrived in countries characterised by 'a political-economic system where consensual relationships among key actors prevail' (Dryzek 1997, p.141). These countries, which include Germany, Japan, The Netherlands, Norway and Sweden, achieved the most successful environmental policy performance through the 1980s and 1990s, as evidenced by indicators of energy and material efficiency and emissions (Dryzek 1997, p.137).

Despite its concrete successes, ecological modernisation remains strongly focused on the objective quadrants. It has shown few signs of the greater awareness of the subjective quadrants that is emerging in the broader sustainable development discourse and has little to say about social justice or the plight of poor countries. Ultimately, ecological modernisation only delivers the objective aspects of sustainability. Further, its ability to deliver the deep cuts in GHG emissions required to stabilise the climate is uncertain. Most of the achievements of ecological modernisation have been delivered without significant disruption to the dominant discourse; deep emission cuts will not be achieved so easily. The techniques of ecological modernisation are likely to be an important component of an integral approach to sustainable development, but will need to be complemented by approaches that give greater attention to subjective development.

7.3.5 Green radicalism discourse

Dryzek divides the variety of radical green discourse into two main categories: green romanticism and green rationalism. The distinction is based on two different reactions to the European Enlightenment. The original Romantics and their modern green counterparts reject 'the Enlightenment's emphasis on rationality and progress' (Dryzek 1997, p.153). In contrast, green rationalism embraces key aspects of the enlightenment, including 'equality, rights, open dialogue, and critical questioning of established practices' (Dryzek 1997, p.153). I will examine both, from an integral perspective, below.

Green romanticism

It is not difficult to locate Dryzek's (1997) **green romanticism** on an integral map, as Wilber (2000c, pp.467-477) specifically identifies an equivalent 'Eco-Romanticism' – the Eco camp discussed in Section 7.2.3. Green romanticism, as outlined by Dryzek (1997, p.155), is mainly concerned with 'the nurturing and development of different kinds of subjectivity, or ways that individuals can experience the world'. Green romantics favour 'an artistic and aesthetic orientation to life and politics' and believe that 'nature and humanity [belong] in an organic relationship best understood and developed through feeling and insight' (Dryzek 1997, p.155). They reject the dry abstraction of scientific rationality and its objectification of nature, seeking a holistic union of subject and nature through a personal transformation towards an ecological sensibility.

Green romanticism is a broad discourse with many varieties. Faced with an issue like climate change, some green romantics will directly protest against coal-fired power stations, others will establish their own self-sufficient dwellings running on renewable energy and others still will argue that GHG emissions are a violation of the relationship between humans and nature and that individual transformation is necessary to re-establish the natural relationship. Some varieties of green romanticism identified by Dryzek include deep ecology, cultural ecofeminism, bioregionalism (as a sense of place), green lifestyle movements, eco-theology and eco-communalism.

As Wilber (2000c, pp.467-477) describes at length, green romanticism, or the Eco camp, mixes positive and negative contributions. I will start with the positive. The green romantic emphasis on individual subjectivity, aesthetics, feeling and artistic expression is a valid attempt to explore diverse perspectives in the psychological quadrant, in response to the Ego camp's assertion of a homogeneous rational ego. Further, the green romantic search for a union of subject and nature is based on a very real insight into the rift between subject and object that the Enlightenment created. The green romantic insight into this rift draws on systems thinking (early vision-logic), recognising 'the holistic nature of the ecological webs in which every individual is enmeshed' (Dryzek 1997, p.156). In most cases, the green romantic insight into the separation of the subject from nature also draws on postmodern values or genuine spiritual insights. That is, green romantic values often transcend rational values.

Unfortunately, in their laudable desire to move beyond the constraints of rationality, green romantics often end up embracing all that is non-rational, and much that is pre-rational (Wilber 2000c, p.470). As Dryzek (1997, p.155) puts it: 'The kinds of subjectivity sought are in some cases radically new, in some cases radically old, looking back to primal human society before the rise of agriculture'. Hence, in many cases, green romantics end up advocating a regression to past societies and past developmental stages; broadly speaking, they recommend a regression to a time when the noosphere was not fully differentiated from the biosphere, although different philosophies idealise different points in history. According to Dryzek (1997, p.158), green romantics within the ecofeminism movement 'look back to egalitarian and matriarchal societies, some complete with goddesses, prior to the rise of cities, kingdoms, and empires'. Wilber (2000c, pp.474-475) argues that some ecomasculinists go even further back, idealising the hunter-gatherer societies of the Neolithic. The deep ecology movement, Earth First!, has a slogan that declares 'Back to the Pleistocene!' (Dryzek 1997, p.155), advocating a regression to pre-history. Of course, it is important to note that all of these movements are diverse and may include many members that do not romanticise the past. Nevertheless, there are strong romantic tendencies within these movements.

In their regression to the biosphere, the green romantics end up trapped in the same flatland that they are trying to escape. Where the Ego camp uses rationality to stand back from the biosphere, the green romantics use feeling to insert themselves into the biosphere (Wilber 2000c, p.471). With this insertion, they abandon all the positive contributions of rationality in the noosphere. They idealise the environmental sensibilities of mythic, magic or archaic societies, failing to recognise that, as I described in Section 7.2.3, very few of these societies actually possessed any sort of ecological awareness. None of these societies, not even nature itself, was the egalitarian paradise that green romantics seek. Equality is a cultural commitment that only emerges from a long process of subjective development.

Some green romantics are aware of the need to develop new types of consciousness as the basis for the reunion with nature (e.g. Dryzek's (1997, p.162) eco-theologians). They seek to 'change the world by changing people, more precisely the way people experience the world' (Dryzek 1997, p.166). However, they lack a theory of subjective development that can guide this process (Wilber 2000c, p.469). Further, in their emphasis on individual subjectivity, they ignore the crucial role of social institutions and cultural movements in any developmental process. The focus of green romanticism is on personal responsibility rather than collective action. Dryzek (1997, p.170) summarises:

> Now, green romantic sensibilities might be sufficient to maintain an equilibrium in which people lived in harmony with nature, but they cannot tell us how to get from our current severe disequilibrium to this harmonious state. There is no theory of the transition, which surely requires some political program, and some kind of action at the collective level, about which romanticism is silent…If there is no structural setting which facilitates the articulation of frustration with the old order, the construction of solidarity against that order, and action based on that solidarity, then the old order will survive.

This is yet another reminder of the need to consider all quadrants. Green romantics may be successful in changing individual values, but individuals are unable to fully express their values at the cultural level due to constraints posed by rational political and social structures (e.g. nation states and party-based democracy). Without a political program in the social quadrant, green romanticism can have no lasting impact.

To summarise, green romanticism typically stems from postmodern or post-rational values. It is a discourse that celebrates individual subjectivity and the psychological quadrant. However, the discourse lacks a developmental theory that can explain the emergence of post-rational insights.

Further, it underestimates the importance of the collective quadrants. There is an underlying assumption that ecological destruction is linked to the emergence of culture, and that by regressing to earlier forms of society, the rift between nature and culture can be healed. Of course, there is no agreement on how far back in history the regression needs to go. The problem here is that human culture, the realm of the noosphere, transcends and includes nature. It is a natural development that cannot be simply abandoned; rather, its positive aspects should be embraced, and its negative aspects progressively addressed.

Green rationalism

According to Dryzek (1997), green rationalism is a diverse discourse that includes many in the European green political parties, social ecologists, the environmental justice movement, social ecofeminists, those committed to bioregionalism as a political program, eco-Marxists and animal liberationists. The common thread in these many movements is a commitment to rational values. Unlike green romantics, green rationalists do not reject the Enlightenment outright, preferring instead to build on its positive aspects and reject its negative aspects:

> Green rationalists recognize that some aspects of Enlightenment are indeed complicit in the destruction of nature and the production of injustice. They agree with romantics that modern science and technology wielded in human arrogance have meant massive environmental destruction, along with profound human costs. But Enlightenment also means equality, rights, open dialogue, and critical questioning of established practices. Green rationalism builds upon this more attractive side of Enlightenment and modernity (Dryzek 1997, p.153).

Green rationalism radicalises selected rational values that are consistent with an ecological orientation, especially those that emphasise equality, human rights, dialogue, and social critique. Morally, the discourse is strongly postconventional in its commitment to social critique, and worldcentric in its emphasis on human rights and equality. On average, green rationalist values correspond closely to the postmodern values discussed in Section 2.3.5; they are pluralistic and communitarian. Green rationalists embrace diversity, recognising that 'the essence of human motivation is multi-dimensional' (Dryzek 1997, p.186).

Cognitively, this discourse is again located at the transition from formal operational cognition to vision-logic. That is, the discourse can recognise complex systems, but is not yet able to recognise the holarchic or nested nature of systems. This cognitive wave is evident in the green rational condemnation of all hierarchy in favour of 'a natural relationship of equality across individuals' (Dryzek 1997, p.185). Green rationalism fails to recognise that its rejection of all hierarchy itself constitutes a hierarchy (i.e. a preference for non-hierarchy over hierarchy). Further, the green rational rejection of hierarchy sits uneasily with the abundant evidence of evolutionary hierarchies in nature itself. It is only with the application of vision-logic that the world is revealed as a series of natural hierarchies that are unproblematic in their healthy forms, so it is clear that vision-logic is not a structure that is included in green rational discourse.

Green rationalists, in contrast to green romantics, argue that it does 'make a difference whether individuals are joined in markets, bureaucracies, cooperatives, or democracies of various sorts. Thus green rationalists are led to contemplate the social dimensions of ecological issues which green romantics normally ignore' (Dryzek 1997, p.173). That is, green rationalists focus particular attention on the social quadrant and seek to develop institutions that are consistent with ecological values, such as network organisations. For green rationalists, the solution to ecological problems 'is not to be found merely in changed individual sensibilities, in any return to a pre-industrial Eden, or in postmodern playfulness. Rather it is to be found in hardheaded analysis of social, political, and economic practice and structure' (Dryzek 1997, p.175).

The rational emphasis on objective analysis of social structures is partly tempered by a commitment to progress, 'grounded in a model of individual human development' (Dryzek 1997, p.187). This commitment to development in the psychological quadrant does not completely prevent green rationalists from embracing flatland, as the green rationalist commitment to social and political change (the social quadrant) is particularly strong. For example, Eco-Marxism argues that: 'Human consciousness is relevant only to the extent it can be tied to [material economic factors]' (Dryzek 1997, p.182). Within the discourse of green rationalism, this is perhaps an extreme example. More common is a tendency to absolutise the noosphere and human separation from nature. For example, social ecology specifically emphasises 'a special place for humanity in the natural scheme of things' and a separate realm of cultural evolution (Dryzek 1997, p.176). In this separation, green rationalists tend to take the Ego camp's path into flatland.

However, unlike most of the flatland discourses that take the Ego path, green rationalism is characterised by the strong presence of ecological values and a more mature form of rationality. The presence of these developmental structures means that green rationalism is open to the application of vision-logic to integrate nature and culture, even if it balks at the idea that natural hierarchies might provide the basis for such integration. As a result, some of the leading thinkers in the various movements that Dryzek includes under green rationalism have moved towards an integral perspective, and away from flatland thinking. Indeed, Dryzek (1997, p.184) notes that green rationalists may welcome 'alternative subjectivities (even romantic ones)', although they retain their commitment to the primary role of action in the social quadrant.

Green rationalism, then, is committed to progress and operates from a genuine insight into the importance of developing new social institutions that allow the full expression of ecological or postmodern values. By working to develop network organisations and new forms of democracy, green rationalism provides a concrete basis for the wider emergence of ecological values. It is a discourse that shows signs of emerging from flatland but has yet to fully embrace the intentional and cultural quadrants. The green rationalist condemnation of all forms of hierarchy remains a significant barrier to the development of the discourse towards an integral structure of consciousness.

7.3.6 Ecological democracy

By way of conclusion, Dryzek discusses a normative discourse called ecological democracy. This discourse would integrate elements from several of the other environmental discourses, recognising that they are not always competitors and may be compatible if applied to different problems, or at different scales. As the basis for integration, or identification of 'productive compatibilities' between discourses, Dryzek (1997, p.198) lists two requirements for 'an intelligent approach to environmental issues':

> The first is a dynamic, structural-level analysis of the liberal capitalist political economy, where it might be headed, and what realistically can be done to alter this trajectory to more ecologically benign ends…[The second is] the capacity to facilitate and engage in social learning in an ecological context.

For Dryzek, the first quality is evident in Promethean discourse and ecological modernisation. Strangely, he omits to mention green rationalism here, which also seems to exhibit this quality. Dryzek notes the problems with the Promethean viewpoint and embraces, instead, the ecological restructuring of capitalism that is the objective of ecological modernisation. From an integral perspective, the type of analysis that Dryzek calls for is characteristic of a postconventional position, where reflection on, and critique of, social norms is possible. However, Dryzek's approach here is limited to the social quadrant. He is concerned with the restructuring of objective political and economic institutions.

The second quality identified by Dryzek is a way of responding to 'the high degrees of uncertainty and complexity' that characterise environmental issues and 'are magnified as ecological systems interact with social, economic, and political systems' (Dryzek 1997, p.198). He advocates 'institutions and discourses which are capable of learning' (p.198). Dryzek identifies four environmental discourses that include elements consistent with social learning. First: 'From democratic pragmatism come discursive procedures for the resolution of disputes through cooperative problem solving' (Dryzek 1997, p.199). That is, Dryzek advocates participatory forms of democracy that allow the expression and integration of pluralistic values. Second: 'From sustainable development comes the possibility of a decentered approach to the pursuit of sustainability' that allows diverse 'experiments in what sustainability can mean in different contexts' (p.199). Third is a reflexive version of ecological modernisation that involves 'institutional change in the direction of democratic experimentation, and open-ended exploration of what ecological modernization itself might mean' (p.199). Finally, green rationalism provides a sense of urgency to drive the radicalisation of the other three discourses, as well as 'plenty of ideas about how political and economic institutions might look in an ecological future beyond industrial society' (p.200).

As learning is essentially a developmental process, and Dryzek elsewhere states his belief in progress, this commitment to learning brings Dryzek close to the integral understanding of development. Further, Dryzek sees learning as both a social process, occurring through institutions, and a cultural process, occurring through discourses. However, Dryzek's ecological democracy falls short of an integral perspective in its failure to link the emergence of ecological awareness to personal and cultural development. In addition, despite his recognition of multiple environmental discourses, Dryzek is ultimately concerned with changing the concrete political and economic institutions of the social quadrant. His project is not one of subjective development and it remains unclear how an ecological democracy might emerge without such development.

7.3.7 Discussion

I have demonstrated in the sections above that an integral perspective provides valuable insights into the nature of each of the environmental discourses identified by Dryzek. Further, I have shown how it is possible to locate each on an integral map by cataloguing the quadrants and developmental structures that underpin each discourse. It is clear from my analysis that there is no simple linear developmental relationship between Dryzek's discourses. No discourse is "more developed" than another discourse. Rather, the discourses show varying degrees of development across multiple developmental streams. Each has apparent contributions to make in the realm of environmental policy. This finding should help to allay the fears of critics that portray integral theory as a ranking exercise that marginalises particular discourses. Instead of simply ranking discourses, integral theory provides a theoretical basis for identifying the positive and negative contributions of particular discourses.

Further, integral theory provides a sound theoretical basis for integration of the positive elements of different discourses, using the principles of nonexclusion, unfoldment and enactment outlined in Section 2.4.3. Applying the principle of nonexclusion, an integral approach to environmental issues would need to find ways to appeal to hierarchical (e.g. survivalist), individualistic (e.g. Promethean), and pluralistic (e.g. green rational) values. It would need to address the objective quadrants (e.g. the ecological modernist emphasis on restructuring capitalism) and the subjective quadrants (e.g. the green romantic emphasis on subjectivity). Where conflicts arise, the principle of unfoldment would provide guidance; discourses applying vision-logic (e.g. some sustainable development approaches), postconventional morality (e.g. green rationalism and ecological modernisation), and/or worldcentric values (e.g. green romanticism) would be preferred. Finally, the principle of enactment is a reminder to look for quadrants, waves and streams that are not considered by any of the discourses and would need to be incorporated into an integral approach. In Chapter 8, I will outline an integral approach to climate change response that applies these principles.

Although an integral interpretation of Dryzek's environmental discourses provides useful insights, it could be argued that Dryzek's particular approach is more open than most cultural approaches to the idea of development. After all, Dryzek believes in progress and recognises that some discourses are more able to cope with the complexity of environmental issues than others. Other cultural theorists are less open, even hostile, to developmental theories. In the next section I examine a theoretical and empirical approach to culture – grid-group cultural theory – that has achieved some popularity as a way of identifying different climate change discourses. Grid-group cultural theorists reject developmental theories, so an integral interpretation of grid-group cultural theory poses some important challenges.

7.4 The relationship between grid-group cultural theory and integral theory

I introduced grid-group cultural theory in Section 4.9.2 and outlined the discourse typology identified by grid-group cultural theorists. As noted there, this typology has been used to generate climate change discourses that have appeared in two major publications on the social dimensions of climate change (see Jochem, Sathaye & Bouille 2000; Rayner & Malone 1998) and in the IPCC's TAR (IPCC 2001b, p.372). As such, grid-group cultural theory is one of the few theoretical approaches to the cultural quadrant that can justifiably claim to have some influence on the climate policy debate, even if its practical achievements to date are few. It is therefore important to consider the theory, and the discourses it generates, in any integral climate change response.

Grid-group cultural theory makes the ambitious claim that its typology of five cultural biases or social solidarities is universally applicable, across all social scales. According to the theory, the mix of the five cultural biases will vary with the specific context and the level of analysis, but the biases themselves are universal (Mamadouh 1999). Thompson, Grendstad and Selle (1999, p.2) go so far as to liken the five cultural biases to sub-atomic particles, in that they are the building blocks of culture, just as electrons, protons and neutrons are the building blocks of atoms. Of course, integral theory also claims universality for its quite different explanation of reality, so there is potential for conflict between the two theories. The most notable difference between the two theories is their position on cultural development; grid-group cultural theorists rejects any notion that one discourse is more adequate than another, while integral theorists interpret discourses as combinations of developmental structures across multiple developmental streams. In this section, I will examine the theoretical basis of grid-group cultural theory, discuss the points of departure from integral theory, and attempt to reconcile the two bodies of theory.

7.4.1 Grid-group cultural theory

Grid-group cultural theory is one name for a theoretical approach that is also known as grid-group analysis, Cultural Theory[60] or the theory of socio-cultural viability (Mamadouh 1999). I follow Mamadouh (1999) in using the term grid-group cultural theory to distinguish this approach from other forms of cultural theory. Grid-group cultural theory has its origins in the work of the

[60] Cultural Theory, capitalised, is the preferred nomenclature used by most grid-group cultural theorists that have addressed climate policy. The capitalisation is used to distinguish this particular cultural theory from others but, as Mamadouh (1999) points out, the unfortunate impression is one of arrogant dismissal of other theories of culture.

anthropologists Mary Douglas and Michael Thompson and the American political scientist Aaron Wildavsky (e.g. Douglas 1982; Thompson, Ellis & Wildavsky 1990).

The theory is driven by an attempt to parsimoniously model the diversity and complexity of cultural commitments; it is one attempt to respond practically to the issue of cultural complexity I raised in Section 7.1. Grid-group cultural theory is committed to the postmodern idea that reality is socially constructed and that sociocultural context will therefore influence individual behaviour (Thompson, Grendstad & Selle 1999). However, it attempts to avoid sliding into unconstrained relativism by arguing that there are a limited number of 'ways in which we bind ourselves to one another' (Thompson, Grendstad & Selle 1999, p.1). Grid-group cultural theorists studied the different ways in which social groups can be organised (i.e. different types of social solidarity) and concluded that the diverse forms of social solidarity can be parsimoniously represented using four or five basic types (Mamadouh 1999). According to the theory, each of these types has 'a distinctive patterning of beliefs and values…[or] *cultural bias*' (Thompson, Grendstad & Selle 1999, p.1) as well as 'a distinctive pattern of *social relationships*' and 'a distinctive *behavioural strategy*' (Thompson, Grendstad & Selle 1999, p.9).[61] In strong versions of the theory, these social, cultural and behavioural elements must be mutually supportive and compatible, however Mamadouh (1999, p.404) argues that the coherence of these three analytical levels 'is a question for empirical research'.

The labels for these different types of solidarity are contested; I will use the most common labels, which are also those used by Thompson and Rayner (1998a) in their initial application of grid-group cultural theory to climate change response. Following this convention, the four social solidarities most commonly identified are **egalitarianism**, **hierarchy**, **individualism** and **fatalism** (Thompson & Rayner 1998a). Some authors identify a fifth **autonomous** solidarity (e.g. Thompson, Grendstad & Selle 1999). I will discuss the derivation of these five positions below.

The classic literature on social theory tends to define social solidarity in dualistic terms. The most common dualistic distinction is that between solidarity based on 'market-driven values, and the regulatory structures of a hierarchical system' (Thompson & Rayner 1998a, p.281). This traditional distinction between markets and hierarchies provided two of the social solidarities listed above. However, Thompson and Rayner (1998a, pp.326-327) show that these two positions are not sufficient to capture the diversity in classical typologies of social solidarity. In fact, at least three positions are necessary to parsimoniously describe the possible modes of solidarity. The third position they identify from the classic social theory literature is egalitarian solidarity.

The fatalist solidarity emerged during the development of the classification scheme that gives grid-group cultural theory its name. According to Thompson, Grendstad and Selle (1999), the different types of solidarity can be classified according to two dimensions of sociality, commonly known as **grid** and **group**. Grid refers to 'the extent to which social relations are patterned by external rules

[61] Italics in original.

and regulations' (Ney & Thompson 2000, p.69). Grid influences 'the ability of individuals to negotiate and bargain their relations with others' (p.69). If social relations are highly regulated (high grid), social transactions between individuals are asymmetrical and inequality is imposed. If there is little regulation of social relations (low grid), social transactions between individuals are symmetrical and individuals are free to negotiate equal relations. Group refers to the strength of the group boundary and collective identity. A strong group boundary leaves group members 'little scope to determine the form of their relationships with those who are not within that group' (Ney & Thompson 2000, p.69) and ties members closely to the group. Figure 7.1 shows the classification of each of the five solidarities according to their grid and group. The fatalist solidarity was added to the three solidarities identified from classical social theory to give a fourth combination of grid and group that completes the conceptual scheme.

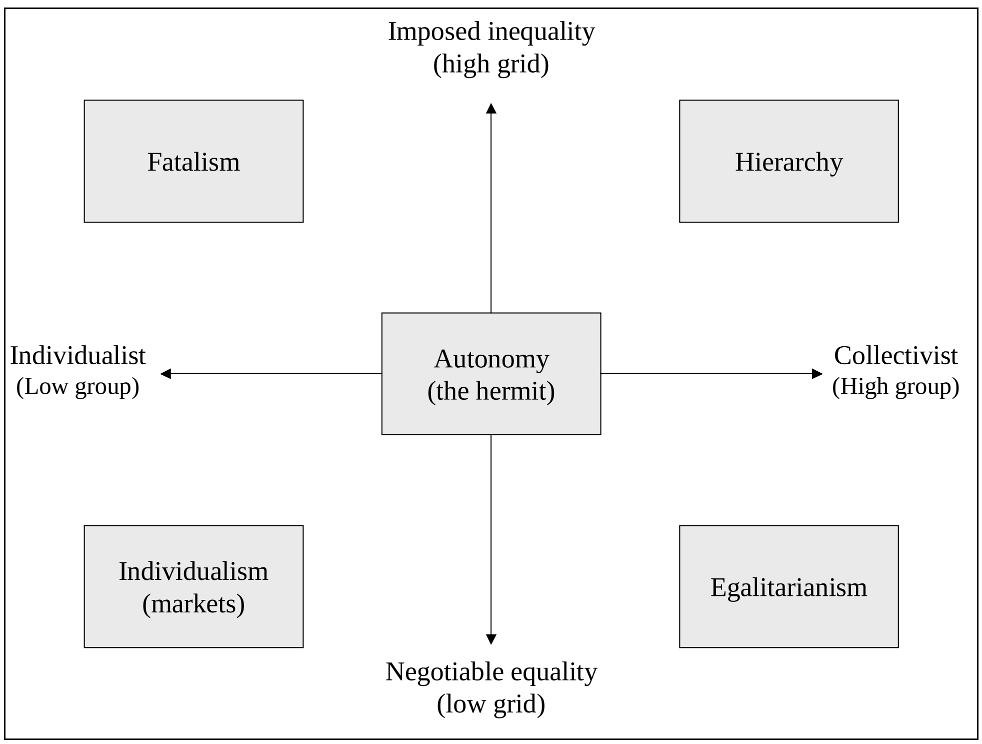

Figure 7.1: The five positions in grid-group cultural theory.

Source: After Dake and Thompson (1999).

Referring to Figure 7.1, hierarchy and fatalism are social solidarities characterised by high grid, which means that inequality is imposed on members of these solidarities. Egalitarianism and individualism are social solidarities characterised by low grid, which means that members of these solidarities are free to negotiate equal relationships, although this freedom does not automatically lead to equality. Identification with the group is low in individualist and fatalist solidarities, which are characterised by unfettered competition between individuals; these solidarities are individualist. Identification with the group is high in hierarchical and egalitarian solidarities, which are characterised by fettered competition between individuals; these solidarities are collectivist. Some grid-group cultural theorists, drawing on empirical research, add a fifth autonomous solidarity, often referred to as the hermit (Thompson, Grendstad & Selle 1999). The autonomous solidarity does not fit the grid-group scheme and is 'taken off the social map' (Thompson, Grendstad & Selle 1999, p.3). The hermit chooses to opt out of coercive social relations altogether and does not form groups. Both the fatalist and the hermit are passive solidarities that do not engage in policy debate, whereas the other solidarities are actively involved in policy debate.

The five positions in Figure 7.1 are central to grid-group cultural theory's 'impossibility theorem', which states that 'there are just five viable forms of social solidarity, all of which will be found, in varying strengths and patterns of interaction, in any social system' (Thompson, Grendstad & Selle 1999, p.2). Thompson (2000) contends that these five solidarities can be found at any social scale, from micro to macro, or individual to global. Each of the five solidarities is best understood as an extreme position. In reality, individuals and organisations will display some mix of these different forms of solidarity and, according to Ney and Thompson (2000), this mix may vary with context. For example, an individual may lean towards a hierarchical solidarity at work, while embracing an egalitarian solidarity at home. In other words, an individual may activate different social solidarities in different contexts. Similarly, an organisation may contain a mix of hierarchical, individualist and egalitarian perspectives. Thus, grid-group cultural theory focuses on the interplay of discourses within institutions and avoids treating individuals or organisations as unitary actors with singular motivations (Thompson & Rayner 1998a, p.294).

Like all good theories, grid-group cultural theory is grounded in empirical research. It emerged from practical attempts to understand policy debates, particularly environmental policy debates, 'in which people…are clearly arguing from different premises and, what is more, showing no tendency to converge towards consensus as the debate progresses' (Thompson, Grendstad & Selle 1999, p.3). By binding themselves to a particular type of social solidarity and participating in the associated discourse, individuals adopt a particular epistemological and moral relationship with nature and a set of shared ethical principles that shape their social interactions (Thompson & Rayner 1998a, p.328). These commitments will influence their response to policy issues of all types, including climate change. In the next section, I discuss Thompson and Rayner's (1998a) application of grid-group cultural theory to climate change.

7.4.2 The application of grid-group cultural theory to climate change

In Section 4.4, I examined different psychological models of climate change response and noted the emerging consensus that socio-cultural models are better able to explain individual climate change response than alternative models. Thompson and Rayner's (1998a) original application of grid-group cultural theory to climate change was driven by recognition of the limitations of the information deficit model of climate change response (see Section 4.4.1) and a desire to apply a socially and culturally sensitive model to climate change response. Thompson and Rayner (1998a) argue that the social solidarities and cultural biases identified by grid-group cultural theory provide a superior basis for distinguishing between different perceptions of, and responses to, climate change than information deficit models or socio-demographic models.

Ney and Thompson (2000) provide additional arguments in favour of the application of grid-group cultural theory to climate policy, and policy in general. For example, they note that there has been 'an enormous growth in *policy output*…[but] little in the way of *policy outcomes*' (p.65), with respect to climate change.[62] Grid-group cultural theory provides one way to foreground the 'divergent socio-institutional discourses' (p.66), political commitments and policy stories that are at the heart of the climate policy debate, thereby illuminating the difficulties faced by those concerned with concrete policy outcomes. The theory allows the policy analyst to move beyond the myth that policy processes are rational or, at least, that they only display one type of rationality. Further, it provides a way of analysing the socio-institutional structures and cultural commitments underlying policy arguments (Ney & Thompson 2000). By analysing different policy arguments, grid-group cultural theory 'introduces both a reflexive and a critical element into policy analysis' (Ney & Thompson 2000, p.69). It identifies which voices are present in a policy argument and the moral agendas that those voices are pursuing.

Thompson and Rayner (1998a) built on earlier work linking the solidarities of grid-group cultural theory to differing myths of nature to identify the ways each solidarity would respond to climate change. They argued that the three active solidarities in grid-group cultural theory agree that climate change is a problem, but profoundly disagree on how to define and address the problem. According to Thompson and Rayner (1998a, p.289): 'The points of conflict in the climate change debate, and the way in which they tend to resurface through all attempts at resolution, indicate that there *are* different underlying and fundamental perspectives jostling for position'. These different perspectives are a consequence of differing 'ideas about nature and equity [that] inform climate change policy debates at all levels from the family hearth to the international negotiation of the Framework Convention on Climate Change' (Thompson & Rayner 1998a, p.266).

In the sections below, I discuss the five perspectives on climate change identified by grid-group cultural theory. This discussion is an expansion on existing work by grid-group cultural theorists, which has tended to focus on the three active solidarities. As with Dryzek's environmental discourses, I will use meta-discourse analysis to demonstrate that each perspective can be interpreted as a particular combination of quadrants, developmental waves and streams. Grid-group cultural theorists are likely to be resistant to such an interpretation; I specifically address some of their concerns in Section 7.4.8.

[62] Italics in original.

7.4.3 Hierarchical discourse

According to grid-group cultural theory, in situations where regulation is strong and there is little scope for negotiation between individuals, hierarchical forms of solidarity emerge. In a hierarchy: 'Individuals interact on the basis of clearly defined roles and tasks, [and] policy outcomes are the result of careful, rational management and propriety' (Ney & Thompson 2000, p.69). The hierarchical solidarity emphasises status, rules and expert administration. Inequity is inherent in the hierarchical solidarity: 'The exercise of authority, and inequality more generally, is justified on the grounds that different roles for different people enable them all to live together more harmoniously than do alternative arrangements' (Thompson, Grendstad & Selle 1999, p.4).

There is close correspondence between these descriptions of hierarchical discourse and the mythic-rational structure described in Section 7.2.3. As in mythic societies, members of the hierarchical solidarity adopt a role-based identity and emphasise status. However, there is also a commitment to rationality. Scientific experts and rational managers have replaced priests and religion at the top of the hierarchy, however the controlling hierarchical, rule-based structure evident in mythic societies remains. Remnants of the religious sensibility remain in the notion that people are 'malleable: born in sin but redeemable by firm, long-lasting and nurturing institutions' (Thompson, Grendstad & Selle 1999, p.7).

Individuals subscribing to the hierarchical discourse identify strongly with the values and objectives of the group, indicating that the average wave of moral development is conventional; that is, individuals follow the rules of society and uncritically accept their place in the hierarchy. As noted by Thompson and Rayner (1998a, p.311), 'benefits are allocated in accordance with an administrative determination of rank, contribution, or need'. Further, there is no explicit role for the citizen in decision-making:

> The citizen is assumed to have entered into a contract with the decision making institution, whereby he or she may be deemed to assent to decisions made through rational procedures of that institution, even though he or she may not like the particular outcome (Thompson & Rayner 1998a, p.319).

This corresponds closely to the authoritarian social structure of mythic-rational societies.

In relation to the natural world, the hierarchical discourse subscribes to the idea that nature is predictable and tolerant within limits (discoverable by certified experts) but perverse if those limits are exceeded (Thompson, Grendstad & Selle 1999; Thompson & Rayner 1998a). Hierarchists therefore seek the certainty and predictability that will allow rational management of nature. Cognitively, this emphasis on certainty and predictability is characteristic of formal operational thinking. However, the recognition that nature will behave unpredictably beyond certain limits requires systems thinking, indicating that hierarchical discourse is starting to make the transition from formal operational to vision-logic cognition.

For the hierarchical discourse, needs are fixed (at any level of economic development) and defined in per capita terms (Thompson & Rayner 1998a, p.301). Consequently, hierarchists define climate change as a population problem; more people will necessarily generate more GHG emissions, increasing the risk that the Earth's carrying capacity will be exceeded. The prescribed policy solutions include regulation and top-down rational management aimed at reducing population. Since most population growth is currently in developing countries, 'responsibility for global climate change lies with the developing countries' (Thompson & Rayner 1998a, p.302). Policies emphasise 'family planning and education in the countries most likely to suffer from rapid population growth' (Ney & Thompson 2000, p.75). That is, hierarchists adopt a sociocentric perspective that does not recognise the ethical standing of those outside their own nation-state (or group of nation-states). The emphasis is strongly on the viability of the group, which is commonly expressed in a focus on the national interest over broader human interests.

Hierarchical discourse appears to occupy the transition between absolutist (mythic) and rational (modern) values. In its emphasis on ecological limits, hierarchical discourse has much in common with Dryzek's survivalist discourse. In its emphasis on rational hierarchy, it has much in common with Dryzek's administrative rationalism. Thompson (2000) argues that the IPCC's emphasis on expertise suggests that its cultural bias is very much towards the hierarchical solidarity.

7.4.4 Individualistic or market discourse

In situations where social relations are largely unregulated and external group boundaries are weak, individuals 'negotiate and bargain their social relations according to their perceived utility' (Ney & Thompson 2000). This results in an individualist form of solidarity that is comfortable with high levels of competition and predominantly market-mediated interactions. The individualistic or market discourse in grid-group cultural theory is committed to libertarian, free market principles and the expansion of the private sphere. For the individualist: 'Fairness consists of equality of opportunity' (Mamadouh 1999, p.400).

Individualist discourse defines climate change as a technical problem of over-consumption of resources resulting from the fact that: 'Historically, market prices have not accurately reflected the full social cost of natural resources' (Thompson & Rayner 1998a, p.298). In the case of climate change, the argument is that the atmospheric resource has not been appropriately valued. The proposed policy solution is to privatise public goods through allocation of property rights and incorporation of externalities into prices (Thompson & Rayner 1998a). That is, climate change would be addressed by putting an appropriate price on GHG emissions, which would stimulate development of technologies to reduce GHG emissions. However, the price must be set in such a way that the cost of climate change response does not exceed the predicted costs of climate change. This ensures that economic growth is not adversely impacted, as 'only economic growth can provide the necessary resources to tackle the expensive task of greening the economy' (Ney & Thompson 2000, p.73).

The strong commitment to market solutions and 'individual pursuit of rational self-interest' (Ney & Thompson 2000, p.73) is typical of Wilber's (2000c) Ego camp, which employs an instrumental form of formal operational cognition to explain an assumed objective reality. This cognitive wave is evident in the language of the discourse: 'Advocates of the pricing and property rights diagnosis and the market solution seem to speak in algebra, their case quantified and presented in equations' (Thompson & Rayner 1998a, p.303). Climate change is seen as a problem that is amenable to rational analysis, without requiring any resort to moral or ethical principles. The values of the market discourse are clearly modern and rational.

The market discourse is worldcentric in that it theoretically allows all people to participate. However, participation is contingent on the individual acting rationally, in an economic sense. This assumption of universal rationality is characteristic of the worldview of rational formalism, discussed in Section 7.2.3. The discourse is also post-conventional, as it is able to reflect on existing market structures, recognise their contribution to climate change and propose changes.

Underlying the market discourse is a representation of nature as benign and robust: 'no matter what humans do to their environment, it will renew, replenish and re-establish its natural order without fail' (Thompson & Rayner 1998a, p.284). While individuals may lose out in competition:

> …there is no danger of everyone losing because nature has been pushed beyond some limit. There is, therefore, no justification for external regulation: there is no need for it, and to introduce it would be to shackle the process of trial-and-error by which we discover how best to convert raw materials into resources (Thompson, Grendstad & Selle 1999, p.6).

This view of nature is typical of Wilber's Ego camp, which sees nature as little more than a source of energy and materials. It also assumes that nature is a vast mechanism that can ultimately be brought under human control. I argued in Section 1.5.1 that the complexity of natural systems, and the deep uncertainty about their future behaviour, makes rational management of this sort impossible. Further, in Section 1.2, I drew attention to the vast body of evidence for biodiversity loss, desertification and the like, which indicates that nature is not as robust as the market discourse assumes.

Individualists are predominantly concerned with the needs of present generations, revealed through voting patterns and consumption decisions (Thompson & Rayner 1998a). The market discourse accepts the involvement of government in correcting market failures, but prefers voluntary solutions to climate change once markets are operating correctly. It is fundamentally committed to economic growth and accepts without question the individual right to the highest possible standard of living. The market discourse described by grid-group cultural theorists has much in common with Dryzek's Promethean and economic rationalist discourses and shares the ideological commitment to economic growth evident in Australian energy and greenhouse policy decision.

7.4.5 Egalitarian discourse

According to grid-group cultural theorists, egalitarian discourse exists where social relations between group members are relatively unregulated and group boundaries are strong, as in enclaves, sects or value communities. There is an emphasis on cooperation rather than competition within the group, coupled with a strong sense of group identity. Policy outcomes emerge 'from the consensual interactions of equal individuals: "direct consent", as it is sometimes called' (Ney & Thompson 2000, p.70). Egalitarians seek an expansion of the public sphere by encouraging direct citizen participation in a wider range of decisions. For egalitarians: 'Fairness is equality of result' (Mamadouh 1999, p.400), not just equality of opportunity.

For egalitarians, climate change is a problem caused by profligacy in industrialised countries (Thompson & Rayner 1998a). Egalitarian discourse 'takes issue with the capitalist imperative for continuous economic growth because infinite growth cannot take place in a finite ecological system such as planet Earth: there are real limits to economic growth' (Thompson & Rayner 1998a, p.295). Climate change is seen as one symptom of a society that is operating beyond ecological limits. Egalitarians argue that rich industrialised countries 'are recklessly pillaging the world's resources with little regard to the well-being of either the planet or the peoples of its poorer regions' (Ney & Thompson 2000, p.71). That is, the excessive consumption and inequity underpinning lifestyles in industrialised countries is unsustainable. Part of the solution, they argue, is a change towards a conserving society characterised by simpler lifestyles that meet real human needs, instead of chimerical consumer wants. In addition, egalitarians argue for adoption of the precautionary principle and decentralised decision-making (Ney & Thompson 2000).

Egalitarian discourse frames climate change as 'a fundamentally moral and ethical issue' (Ney & Thompson 2000, p.71). Consequently, the discourse displays a greater span of moral concern than either hierarchical or individualistic discourse. Egalitarians recognise that GHG emissions from developing countries are far lower than those of developed countries, so the developed nations have an ethical duty to reduce emissions first. As well as recognising the rights of those in developing nations, egalitarians extend their concern to the natural world, arguing that 'human activity must be viewed in a holistic context; the destruction of nature means the destruction of mankind' (Thompson & Rayner 1998a, p.295). That is, egalitarian discourse is characterised by a worldcentric moral sense that theoretically extends care to all people and all life. This moral sense is reflected in egalitarian language, which employs 'impassioned sermons, urging strong moral imperatives' (Thompson & Rayner 1998a, p.303). Values are pluralistic, relativistic, ecological and postmodern.

Underlying egalitarian discourse is an understanding of nature as ephemeral, fragile and intricately interconnected: 'Far from being stable, the natural environment is seen to be in a precarious and very delicate state of balance. The least disturbance or upheaval may trigger a complete collapse in the system' (Thompson & Rayner 1998a). Egalitarians therefore adopt a cautious approach that emphasises protection of nature. The adequacy of the egalitarian myth of nature is a matter of perspective. On a global scale, it seems that nature is quite robust, and will likely survive any disturbance of which humans are capable. However, on a local scale, extinction of species at far above the background level is a reality. That is, particular elements of biodiversity are indeed fragile. Therefore, the egalitarian myth of fragile nature makes sense if one inherently values all life. Regardless, the egalitarian recognition of the life support role of natural systems and the web of connections between systems is evidence of a cognitive transition from formal operational thinking to vision-logic. However, like Dryzek's green rationalists, egalitarian discourse falls short of embracing vision-logic as it rejects the notion of natural hierarchies.

Egalitarian discourse focuses attention on social and economic imbalances that contribute to environmental problems. It raises issues of equity, justice and the need for social and cultural change (Ney & Thompson 2000). It links environmental issues to a 'wider social malaise' (Ney & Thompson 2000, p.72). In this, egalitarian discourse displays a deeper postconventional morality than market discourse; it cultivates sufficient critical distance from societal norms to develop a coherent critique and a prescription for social change that may be quite radical. However, like Wilber's Eco camp, egalitarian discourse often ends up advocating a regression to nature and abandonment of capitalism, rather than embracing progressive solutions. Alternatively, like green romanticism, it advocates a change in values without having a clear understanding of how such a change might come about. Egalitarian discourse combines elements of Dryzek's survivalism (in its emphasis on limits), sustainability discourses (in its emphasis on changing social and economic structures) and green radicalism (in its emphasis on changing values and politics).

Egalitarians emphasise participation as a means of securing explicit consent for policies: 'Active participation, with decisions based on the direct consent of everyone, is the only basis for legitimacy' (Thompson, Grendstad & Selle 1999, p.4). Legitimacy also requires a strong sense of responsibility to future generations. Egalitarians favour cooperative solutions that require action at all levels. That is, individuals must take responsibility for changing their lifestyles, but governments and corporations must provide regulation and leadership where appropriate. In this emphasis on multi-level institutions, egalitarian discourse begins to advocate the type of planetary institutions supported by the integral structure of consciousness and discussed in Section 7.2.3. However, on the whole, egalitarian discourse subscribes to postmodern rather than integral values.

As noted in Section 7.2.3, there are healthy and unhealthy forms of postmodern values. Wilber (2002) explores the unhealthy manifestations of postmodern values at length. In correctly stressing multiple perspectives and the importance of interpretation, postmodernists all too often end up arguing that their particular interpretation of reality is the one true interpretation. This unhealthy form of postmodernism is evident in some of the descriptions of egalitarian discourse by grid-group cultural theorists. For example: 'Witch-hunting and schism are endemic in the egalitarian solidarity, because individuals can exercise control over one another only by claiming to speak in the name of the group: a claim that is supported only in those situations where everyone gives their support to a decision' (Thompson, Grendstad & Selle 1999, p.4). As such situations are rare, egalitarian discourse can degenerate into arguments over whose interpretation of reality better represents the group. In environmental interest groups, this often manifests as disagreement over how best to engage with government and the corporate world – through partnership or protest (see, for example, Hamilton & Macintosh 2004). Egalitarian discourse, as a result of its strong group boundaries, often adopts an us-or-them mentality, in which all those who do not accept the moral and ethical imperatives of egalitarianism become the enemy. Consequently, despite its healthy tendency towards greater inclusiveness, egalitarian discourse does not, in itself, provide a solution to environmental and social problems.

7.4.6 Fatalist discourse

The fatalist solidarity is characterised by highly regulated (asymmetrical) social relations 'in a setting where there is little by way of protective boundary-formation (low group)' (Ney & Thompson 2000, p.70). The fatalist solidarity is not held together by its members but by the impact of the active solidarities. Fatalists are socially isolated, 'their lives are largely determined by rules that are not of their making', but they are not necessarily unhappy (Ney & Thompson 2000, p.70). Nevertheless, fatalists perceive the world as a competitive place in which they have little power. Policy is something imposed on fatalists, over which they have little or no control. Fatalists 'know that physical nature is capricious (operating without rhyme or reason) and that man is fickle (inconsistent from one transaction to the next and therefore inherently untrustworthy)' (Thompson, Grendstad & Selle 1999, p.7). As nature is unpredictable, there is no point in attempting to manage nature. For the fatalist, nature is to be endured or enjoyed.

Of the discourses considered so far, fatalism is the most difficult to interpret from an integral perspective because it can arise for different reasons and in different contexts. The fatalist is primarily concerned with 'personal or familial survival' (Thompson, Grendstad & Selle 1999, p.8), rather than the well-being of society. This would seem to indicate that fatalist values are magical-animistic, egocentric or absolutist-religious (mythic). From these various value perspectives, fatalists will see their fate as determined by the spirits, powerful figures or the hierarchy. In this interpretation, fatalism is a stage that people pass through in the course of their healthy psychological development. However, it seems plausible that a fatalistic outlook could also arise as a result of arrested development or unhealthy regression, brought on by oppressive social conditions. For example, an individual who normally embraces rational values may need to adopt egocentric values to survive when faced with oppressive or dangerous conditions, such as poverty, warfare or disaster.

Thus, I believe that the fatalist solidarity can arise in very different ways, which depend on the social and cultural context. In industrialised democracies, where the average cultural centre of gravity is rational, fatalism is likely to arise when individuals are excluded from participation in society as a result of disadvantage. In this case, fatalism is a response to oppression linked to an unhealthy regression in psychological development. In contexts where the average cultural centre of gravity is magical or early mythic, fatalism may be a healthy expression of the dominant structure of consciousness with the potential to be transcended as development continues.

7.4.7 Autonomous discourse

The autonomous discourse, for those grid-group cultural theorists that recognise it, is 'one of withdrawal from coercive and manipulative relations: this individual is not controlled by others and is not controlling others' (Mamadouh 1999, p.400). The autonomous discourse is the discourse of the hermit. It includes elements from the other discourses but distances itself from those discourses: 'The hermit, unlike the fatalist, is not socially isolated, but he or she does have to be careful to avoid the sort of mutual expectations' that are part of the other solidarities (Dake & Thompson 1999, p.420). The hermit chooses to disengage from:

> … all four "coercive" solidarities and binds himself or herself into autonomy (characterized by the minimization of all transactions and the internalisation of accountability and supported by the not-easily-communicated conviction that all dualisms – of which the distinction between physical and human nature is one – are false (Thompson 2000, pp.98-99).

The hermit believes that physical and human nature 'are subsumed within an endless cycle that, in turn, subsumes the…myths of physical and human nature' associated with the other solidarities (Thompson 2000, p.98). The emphasis in autonomous solidarity is on meditation (Thompson 2000, p.99).

It is tempting to identify the autonomous solidarity with the integral structure of consciousness. Transcending the other solidarities, it nevertheless includes elements from each. It rejects dualisms and practices meditation, seeking spiritual knowledge. Certainly, some aspects of the autonomous solidarity are consistent with an integral structure of consciousness. However, the hermit's disengagement from social relations seems inconsistent with integral theory, which advocates not only continued personal development but also compassionate assistance for all people at all waves of development. It may be that the autonomous solidarity captures some of the higher spiritual waves of development identified by integral theorists, beyond even vision-logic and worldcentric values. However, as a response to the environmental and social problems that humanity currently faces, the autonomous discourse offers little by way of practical guidance.

7.4.8 Discourse interactions

Grid-group cultural theory, with its emphasis on social relationships, cultural bias and behavioural strategies, directly addresses three of the quadrants: the behavioural, social and cultural. It also addresses the intentional quadrant by recognising individuality, although it particularly emphasises the relational nature of individuality (Thompson, Grendstad & Selle 1999, p.12). Further, grid-group cultural theory does not attempt to argue that any of behaviour, culture or society 'is causally prior' (Thompson, Grendstad & Selle 1999, p.10). Where grid-group cultural theory does start to differ from integral theory is in its treatment of the interactions between the different discourses it identifies.

Thompson and Rayner (1998a) argue that the three active discourses exist in a dynamic disequilibrium in which alliances and relative strengths continually change but the discourses themselves remain stable. That is, there is no evolutionary progression from one discourse to another. Since this is a significant point of departure from integral theory, it is important to understand exactly what type of development grid-group cultural theorists reject. The following passage is indicative:

> Instead of one homogeneous traditional blob, miraculously transformed into an equally homogeneous modern (or postmodern) blob, we need the idea that we always have been and always will be heterogeneous, with different social solidarities (and their supporting perceptions, discount rates and preferred solutions) pulling in different directions. The relative strengths of these solidarities will change over time, as will their patterns of interaction, and it is in these dynamic and structured contentions and transformations that we should seek to anchor our explanations (Thompson & Rayner 1998a, p.275).

Here, Thompson and Rayner reject the notion of development from one homogeneous structure (traditional) to another (modern). However, integral theory also rejects this notion, arguing instead that development is a rich and complex process involving quadrants, waves and streams, so that it is not possible to say that society is simply at a particular stage, whether traditional, modern, or postmodern. Integral theory is able to capture the heterogeneity that Thompson and Rayner describe. Indeed, the notion of numerous developmental waves and streams is significantly more flexible than the notion that there are only five competing social solidarities.

Thompson and Rayner also take issue with the 'miraculous' transformation from traditional to modern values, implying that there is no driver that could cause development from one structure to another. In Section 7.2.3, I outlined in some detail the historical drivers for sociocultural development and demonstrated that the structures of consciousness that have emerged over the course of human history have been progressively more inclusive and cognitively complex. New structures emerge to address the limitations of the previous structure. Thus, development is not a miraculous process in the sense that Thompson and Rayner imply. Development simply builds gradually and creatively on previous successes to create increasingly adequate and inclusive structures.

More importantly, Thompson and Rayner argue in the above passage and elsewhere that the social solidarities of grid-group cultural theory 'always have been', without addressing how these categories emerged in the first place. These discourse positions do not exist in animals other than humans, so it would seem that there must have been development at some point. Did the discourse positions emerge fully formed at the point that humans emerged from our hominid ancestors, perhaps with the development of language? This is highly unlikely; what value would an individualist discourse, for example, have in a small hunter-gatherer tribe completely reliant on the other members for survival? Grid-group cultural theory is silent on this question of origins. Integral theory, which argues that the social solidarities are in fact the result of an ongoing process of sociocultural development (discussed in Section 7.2.3), seems to have far greater explanatory power here. It provides the cultural heterogeneity that grid-group cultural theory seeks, while embedding this heterogeneity in a process of sociocultural development. Further, it is open to the possibility that other solidarities might emerge in the future, which is a more sensible approach to deep uncertainty about future developments.

Elsewhere, Thompson and Rayner (1998a, p.328) are critical of 'unidirectional' theories of social development. As I noted at the start of Section 7.2.3, integral theory does not argue that development is unidirectional. Evolution can involve regression, uneven development across quadrants and streams, disaster and the establishment of unhealthy forms of developmental waves. However, integral theory does argue that the general tendency of evolution is towards greater complexity and greater inclusion. The historical evidence for this argument, across the quadrants, is overwhelming. This understanding of development allows each of the active discourses in grid-group cultural theory to be contextualised. Hierarchical discourse is sociocentric, extending its circle of care only to those within its particular society, typically defined as the nation-state. Individualistic discourse moves towards a worldcentric perspective that includes all people, as long as they behave in an economically rational way. It assumes that rational values are universal. Egalitarian discourse, in its healthy forms, adopts a deeper worldcentric perspective that extends membership to those with different values and, often, to the non-human world. It is more inclusive than the other discourses. If inclusiveness (i.e. authentic democracy) is an objective, then egalitarian discourse is clearly preferable to the alternatives.

Despite their argument that no discourse is superior to any other, Thompson and Rayner occasionally make judgements like the one I have just made. For example: 'The population diagnosis [hierarchical] combines a narrower moral imperative than the profligacy diagnosis [egalitarian] with a simpler technical logic than that of the pricing position [individualistic]' (Thompson & Rayner 1998a, p.303). Here, Thompson and Rayner explicitly state that the egalitarian position is more morally inclusive than the hierarchical position and that the individualistic position is more technically complex than the hierarchical position. Integral theory allows these judgements to be brought into the open.

7.4.9 Policy implications of grid-group cultural theory

Grid-group cultural theory argues that the different discourse positions will never agree, as they contradict each other, define themselves in opposition to each other, and are in endless contention with one another (Ney & Thompson 1999; Ney & Thompson 2000; Thompson, Grendstad & Selle 1999). As Mamadouh (1999) puts it: 'The cultures are antagonist, they are inherently adversarial'. Integral theory takes a similar perspective, arguing that the integral structure of consciousness (vision-logic) is the first that is able to integrate multiple perspectives without seeing them as in conflict. Earlier structures of consciousness are in continual conflict with each other.

Importantly, many grid-group cultural theorists do not see this contention and argumentation as a bad thing. For example, Ney and Thompson (2000, p.67) take a Habermasian view, defining argument and conflict as a fundamental part of the policy process that needs to be harnessed: 'Communication is based on reasoned argument, in which both actors draw on intersubjectively shared norms and values, with the aim of establishing mutual understanding as the basis for policy action' (Ney & Thompson 2000, p.67). They maintain that: 'Policy formulation, policy planning, and even policy implementation…emerge from argumentative processes that conventional policy analysis has so far ignored' (Ney & Thompson 2000, p.68). Further: 'A policy debate that can harness the inherent communicative and argumentative conflict between different story-tellers will profit most from the constructive interaction between different proponents' (Ney & Thompson 2000, p.77).

Here, grid-group cultural theory takes a normative turn, advocating policies that heed all the voices: 'a society or an organisation in which the different cultures are present and acknowledged will be less prone to surprise, it has a broad repertoire of strategies to deal with a broad range of problems, and it is better equipped to learn' (Mamadouh 1999, p.403). The quality of communication, and therefore of policy outcomes, will be improved if all solidarities are represented. The underlying argument is that none of the discourses is wrong, although none is completely right (Ney & Thompson 2000). Further, none of the discourses can be reduced to any of the others. Any policy response that ignores one or more of the discourses will be a partially effective response that lacks democratic legitimacy (Ney & Thompson 2000).

The normative policy commitments to emerge from grid-group cultural theory are broadly similar to those arising from deliberative democratic theory, particularly Dryzek's theory of discursive democracy (see Section 4.11.4). Further, in seeking to include multiple voices in policy synthesis, both theories have similar objectives to integral theory. In Chapter 8, I will examine policy processes that seek to give voice to, and integrate, multiple discourses. Here, I will note that, despite clear theoretical differences, the practical implications of grid-group cultural theory and integral theory are not that different.

7.4.10 Discussion

It seems clear from the discussion in this chapter that the five social solidarities identified by grid-group cultural theory, like Dryzek's environmental discourses, can be readily located on an integral map. Hierarchical discourse corresponds quite closely to the mythic-rational structure of consciousness, displaying absolutist (mythic) values, conventional morality, sociocentric moral span and formal operational cognition. Individualistic discourse is rational, displaying individualistic (modern) values, formal operational cognition and the early stages of worldcentric morality, limited by an assumption of universal rationality. Egalitarian discourse is ecological and postmodern, displaying pluralistic values, late formal operational to early vision-logic cognition, postconventional morality and a deeper worldcentric perspective that accepts all people and can extend to other living things. In Western countries, fatalism is usually an egocentric response to oppressive social conditions. Autonomy is a postconventional moral response that rejects the social and cultural constraints on the individual's spiritual search.

While grid-group cultural theorists are resistant to the idea that there is an evolutionary progression between discourses, I showed in Section 7.4.8 that the integral theory of development is generally consistent with grid-group cultural theory and, where there are inconsistencies, integral theory has greater explanatory power. Consistency between the theories would be further improved if grid-group cultural theorists moved away from the strong version of the theory in which the social, cultural and behavioural elements of the solidarities are always aligned and mutually supportive. From an integral perspective, it is possible for behavioural, psychological, social and cultural developments to be at different stages. Indeed, uneven development across the quadrants provides crucial developmental pressure (Wilber 2003a). For example, the rapid development of new social practices and technologies in the social quadrant can drive cultural transformation in the cultural quadrant, or vice versa. Therefore, an integral perspective supports a weaker version of grid-group cultural theory in which the coherence of social solidarity, cultural bias and behavioural strategies is an appropriate topic for empirical research.

Consistency would also be improved if grid-group cultural theorists were more flexible about the idea that there are only five possible discourses. Some discourses may not be well represented in situations studied to date. Others may still be emerging. Of course, acceptance of more than five possible discourses would represent a challenge to the conceptual scheme shown in Figure 7.1, so grid-group cultural theorists might be reluctant to take this step.

Despite the points of contention, grid-group cultural theory is an important attempt to capture some of the complexity of the cultural quadrant, without sliding into unconstrained relativism. The ability of many grid-group cultural theorists to identify different solidarities, while not identifying solely with any of the solidarities, is an important step towards an integral perspective. Consider, for example, Thompson and Rayner's (1998b, p.165) passage on myths of nature:

> Thus, within the extreme scenarios of nature as either unstable or stable, there lies the reality of nature functioning in a resilient and adaptive fashion. Resilient nature is not a perspective that is captured by any one of the myths of nature alone; it is best interpreted through a collective plurality of views.

This acceptance of both plurality and the need for a parsimonious theory to describe plurality is consistent with integral theory. What is missing is an acceptance of development. Consequently, the policy prescriptions of grid-group cultural theorists, while valuable, do not attempt to stimulate and facilitate processes of personal and cultural development. In Chapter 8, I will propose policies that do attempt this.

7.5 Discourse coalitions and integral theory

I believe my discussion in Sections 7.3 and 7.4 has already made the point that integral theory can be used to reinterpret and relate discourses identified by other authors. In this section, for completeness, I will develop a brief integral interpretation of Bulkeley's (2000b) discourse coalitions in the Australian climate policy network, discussed in Section 4.9.3. I noted in Section 4.9.3 that the concept of discourse coalitions integrates discourses in the cultural quadrant with social practices and institutions from the systemic quadrant. Here, I will focus on the developmental structures that are evident in the discourses or storylines adopted by the discourse coalitions (i.e. the cultural quadrant).

Bulkeley (2000b, p.739) identifies a resource-based discourse coalition that emphasises:

> …the need to act in the (economic) national interest, to ensure that developing countries participate in any international agreement, and, in the light of scientific uncertainty and the potential costs of action, to pursue measures which have a minimal economic impact.

Although the concept of a discourse coalition is that its members do not have to share motivations as long as they share a storyline, the motivations and developmental structures of the members of the resource-based coalition seem quite consistent. The storyline is very similar to that professed by Wilber's Ego camp, Dryzek's Promethean and economic rationalist discourses and grid group cultural theory's market discourse. The strong economic focus of the resource-based coalition indicates the application of an instrumental version of formal operational cognition and adherence to modern values. The resource-based coalition defends the material interests of its members and rejects the ethical argument that developed countries should lead climate change response; this indicates a sociocentric perspective. Finally, the resource-based discourse coalition defends the status quo, indicating a conventional moral perspective.

Bulkeley's greenhouse action discourse coalition is less coherent – its members do share a storyline, but do not appear to share motivations or beliefs. The coalition includes insurance companies concerned about the economic impacts of climate change on their business and motivated by modern values and a sociocentric perspective. It includes public interest groups concerned about the environmental and social impacts of climate change, operating from a worldcentric perspective, postmodern values and vision-logic cognition. It also includes emerging sustainable energy businesses that may be applying early vision-logic but are primarily motivated by modern values.

The important point to make here is that integral theory and the discourse coalition concept operate at different, but compatible, levels of explanation. Integral theory identifies the underlying developmental structures and motivations of people across multiple contexts, without providing detail on how these structures and motivations manifest in a particular context. In contrast, the discourse coalition concept is contextual and specific and allows detailed analysis of how different actors interact in a real situation. In this case, the greenhouse-action coalition has formed out of the necessity of confronting the dominant resource-based coalition, for multiple reasons. If successful in prompting a strong climate change response by the Australian Government, it would be reasonable to expect that the greenhouse-action coalition would dissolve and members would pursue their more specific interests, perhaps in opposition to each other. Integral theory indicates that the coalition is likely to be an uneasy one due to conflicts in values and worldviews.

7.6 Conclusions

In Section 7.1, I outlined the objectives of this chapter. Here, I draw conclusions in relation to each of those objectives. First, in Section 7.6.1, I examine what the analysis in this chapter has revealed about cultural complexity and the practical task of policy action when faced with cultural complexity. Second, in Section 7.6.2, I consider the degree to which a developmental perspective is consistent with the three discourse approaches considered in this chapter. Finally, in Section 7.6.3, I summarise the normative policy commitments of the three discourse approaches as a starting point for the development of a proposed integral policy response to climate change in Chapter 8.

7.6.1 A theory of cultural complexity

Dryzek's environmental discourses, the solidarities of grid-group cultural theory and Bulkeley's Australian discourse coalitions are three attempts to model cultural complexity so that the influence of culture on environmental policy can be better understood. As noted in Section 7.1, the development of a theory and method that strikes an appropriate balance between accurate and sensitive representation of cultural complexity and a practical desire to develop generally applicable tools and categories is a central challenge for cultural studies and, indeed, for integral theory. As Adams (1995, p.201) puts it: 'too much abstraction makes one a simpleton, and too little leaves one hopelessly mired in the overwhelming complexity of reality'. In other words, given the social construction of reality, where is the 'reasoned stopping place, somewhere between unity and infinity' (Ney & Thompson 1999, pp.219-220) that balances cultural sensitivity with practicality.

While extreme postmodernists might reject any attempt to reduce cultural complexity to a limited number of categories, other theorists recognise that this is not only practical but also more representative of the way cultural complexity plays out in reality. As Dryzek (2000, p.78) puts it: 'What we see [in reality] is a relatively small number of competing discourses, rather than a wild proliferation of subject positions'. The question then, for cultural and integral theorists, is how many such discourses are there?

Dryzek found nine descriptive discourses and one normative discourse sufficient for his discussion of environmental politics. Grid-group cultural theory uses five social solidarities, with corresponding cultural biases and behavioural strategies; in policy discourse, only three of the solidarities are considered relevant. Bulkeley used only two discourse coalitions to frame her discussion of the Australian climate policy network. All of these approaches have explanatory power in their specific contextual applications. However, I have demonstrated in this chapter that all of the discourses identified by these authors can be readily interpreted as combinations of developmental structures and streams postulated by integral theorists. This suggests that direct application of integral theory to guide discourse analysis in the contexts considered by these authors would have as much, if not more, explanatory power than their diverse methods. For example, where grid-group cultural theory recognises two dimensions (grid and group) distinguishing discourses, integral theory draws on multiple developmental streams to provide a more nuanced understanding of discourses.

A question remains over the universal applicability of the developmental structures identified by integral theory. Grid-group cultural theory claims universal applicability so the integral interpretation of the theory developed here will be equally applicable in other contexts. However, Dryzek's environmental discourses and Bulkeley's discourse coalitions are issue-specific, emerging from detailed discourse analysis in a specific arena. It remains an empirical question whether integral theory will be equally useful in other contexts. Further, the initial identification of discourses is a qualitatively different task to reinterpretation of discourses that have already been identified. The value of integral theory for discourse identification requires further testing. Nevertheless, the results in this chapter are promising and the developmental structures discussed in Section 7.2 are undoubtedly a useful analytical tool.

Although it is clear that integral theory has explanatory power for discourse interpretation, it does not explicitly address the question of cultural complexity raised above. There are many different developmental streams in the cultural quadrant and numerous developmental waves in each stream. It remains unclear how many of these need to be considered in a specific context. I have made a tentative selection in this chapter of the cultural streams that seem particularly relevant to climate policy. These include cognitive development, moral span, identity, values, myth and metaphor, worldviews, storylines or narratives, ethical positions and group inclusiveness. I have also found the broad historical structures of consciousness discussed in Section 7.2.3 useful as integrating discourses comprising multiple developmental streams. Further, it is clear that developments in other quadrants, particularly the systemic quadrant, interact with cultural development.

All of these developmental waves and streams are important. In practice, integral theorists often use developmental structures in the values stream, particularly those identified by spiral dynamics, as integrating labels for structures across multiple streams (e.g. Beck & Cowan 1996; Hargens 2003; Wilber 2001). This is recognition of the important role that values play in determining individual attitudes and providing a basis for mutual understanding and discourse formation in the cultural quadrant. In Section 2.3.5, I outlined my preferred labels for the different value stages: archaic, magic, egocentric, mythic, modern (or rational), postmodern (or ecological) and integral. Thus, where grid-group cultural theory uses five solidarities, only three of which participate in policy, I advocate consideration of at least these seven value stages (six if archaic is excluded, as it does not participate in policy). The other developmental streams can be used when more detailed analysis is required.

7.6.2 Development and discourse

I have argued in this chapter that the discourse classifications provided by Dryzek (1997), grid-group cultural theory and Bulkeley (2000b) are valid maps of the cultural landscape that are generally consistent with integral theories of the cultural quadrant. The major point of contention between integral theory and these other approaches is over the relationships between discourses. Integral theory argues that the discourses can be related developmentally; that is, some discourses contain developmental waves that transcend and include developmental waves in other discourses. Dryzek (1997), with his stated belief in progress, seems open to this idea. Bulkeley (2000b) does not specifically address it. Grid-group cultural theory, on the other hand, argues that there are only five solidarities, that all five solidarities rely on each other, and that the relationship between the solidarities is a shifting disequilibrium or, at best, a virtuous learning circle (Ney & Thompson 1999). As a result, grid-group cultural theory is in conflict with integral theories of development.

I have demonstrated in this chapter that, regardless of the theoretical orientations of the different discourse approaches, each of the identified discourses can be interpreted developmentally as a combination of developmental structures across multiple streams. This developmental interpretation has important implications, some of which may be unpopular. For example, egalitarian discourse is in some ways superior to hierarchical and market discourse, as it gives moral consideration and membership to a wider population that includes people in other countries, future generations and, often, other species. This raises the possibility of ranking discourses, which is anathema to many theorists, particularly postmodernists. However, I want to make it clear what this ranking involves, drawing on Wilber (2003d, p.140):

> There are those who maintain that societies cannot be ranked, and those who maintain that societies can be ranked. I agree with both. Events within streams – such as slavery and physical health – can indeed be ranked…Likewise, [cultural] centers of gravity can be ranked…But the uneven nature of [sociocultural development] makes it virtually impossible to simply say, this society is better than that one. Societies, in that sense, cannot be ranked.

So, I am not arguing that egalitarian discourse is superior to hierarchical and market discourses in all regards; however, it is clearly superior in terms of the circle to which it extends moral consideration. On the other hand, egalitarian discourse is unable to provide the stability and order that is required by individuals or societies emerging from periods of chaos and conflict; hierarchical discourse is clearly superior in this regard. The point I wish to make is that each discourse can contribute elements to an integral climate policy, however it is only with the emergence of the ecological values underpinning egalitarianism that individuals and cultures begin to deeply care about climate change. An important part of any integral climate policy will comprise strategies to facilitate individual development towards, and beyond, egalitarian values. The understanding of discourse relationships promoted by grid-group cultural theory draws attention away from personal and cultural development and neglects the creativity and complexity that drives development.

A developmental perspective on climate discourses also provides answers to some important questions that are ignored by grid-group cultural theory. For example, grid-group cultural theory has little to say about how its five solidarities arose in the first place, and when they arose. Integral theory has a lot to say about this, as discussed in Section 7.2. Grid-group cultural theory accurately identifies the cultural structures that have been most active in Western society over the past thirty years – mythic-rational (hierarchical), modern (individualistic) and postmodern (egalitarian) discourses. It is less successful in understanding the structures and discourses that precede mythic-rational discourse and those that are starting to emerge beyond postmodern discourse. Grid-group cultural theory labels all the structures before the mythic-rational structure as fatalist and non-participating, which ignores both the important differences between these structures, and their potential policy contributions.

To the extent that it recognises developmental structures beyond the postmodern, grid-group cultural theory attempts to capture these with the concept of the autonomous hermit. This is not all that inaccurate, as there is not yet a widespread cultural movement that evidences integral values. Generally, it is scattered individuals who are operating from the integral structure of consciousness. However, by failing to acknowledge the vast body of evidence for psychological and cultural development, grid-group cultural theorists fail to recognise that the values of the hermit are central to the normative commitments of their theory.[63] It is only the integral structure of consciousness that is capable of harnessing and integrating the contestation and conflict between discourses by applying a developmental perspective.

[63] There are some limited exceptions. For example, Adams (1995) recognises that the detachment of the hermit provides the potential for greater reflection and insight into the contestation of policy discourses.

7.6.3 Normative policy commitments

Both Dryzek (1997) and the grid-group cultural theorists (e.g. Ney & Thompson 1999) conclude with a normative commitment to a form of integration of the discourses they identify. Dryzek's ecological democracy combines elements from Promethean discourse, ecological modernisation, democratic pragmatism, sustainable development and green rationalism. Grid-group cultural theory seeks to integrate the five solidarities by directing their argumentation and contestation towards constructive policy outcomes.

I believe that the integration sought by Dryzek and the grid-group cultural theorists is only possible with the emergence of the cognitive capacity for vision-logic. Vision-logic allows the identification and summation of plural perspectives within a coherent (developmental) framework. Further, vision-logic needs to be supported by a worldcentric ethic that extends consideration to all people. Worldcentric recognition allows the inclusion of each of the discourses considered here, providing for greater democratic authenticity. In other words, the integration sought by both Dryzek and grid-group cultural theorists is the same integration sought by integral theory. Despite disagreement over the exact number and nature of perspectives requiring integration, all three approaches are fundamentally consistent in their desire to step back from unconstrained relativism, identify the requisite cultural variety for democratic policy development and provide ways to include that variety in policy processes.

What is missing from Dryzek's discussion, and from grid-group cultural theory, is an explicit recognition that the type of integrative thinking each advocates only emerges after a long process of personal and cultural development. Integral theory makes this developmental process explicit and, in so doing, points to new political strategies for achieving normative commitments. All three approaches seek to design policies so that they appeal to, or at least are acceptable to, all of the major discourses or worldviews participating in the policy debate. Only an integral approach seeks to also design policies so that they facilitate healthy personal and cultural development. In Chapter 8, I will propose an integral policy response to climate change that builds on these insights.

8. An Integral Climate Change Response

> If it is true that the actual contours of tomorrow are shaped by our visions of tomorrow, then a more integral vision promises a more inclusive future for all humanity.
>
> - Ken Wilber, Foreword, *Futures Beyond Dystopia* (Slaughter 2004)

> If you are thinking a year ahead, sow seed. If you are thinking ten years ahead, plant a tree. If you are thinking one hundred years ahead, educate the people.
>
> - Kuan Tzu, Chinese Poet, 500 B.C.

8.1 Introduction

In this chapter, I draw on the analysis so far and some additional theoretical and analytical work to propose an integral Australian policy response to climate change. In Chapter 2, I summarised the general theoretical and methodological principles of integral theory and touched on some of its practical implications. Here, my task is to apply integral theory to the specific case study of climate change and the specific context of Australia. The guiding research question is:

- How can integral theory be used to improve energy and greenhouse policy development processes and outcomes in Australia?

The integral policy process I propose here is intended as a long-term normative ideal but includes components that should have practical short-term benefits.

In Section 4.11.4, I touched on Dryzek's discussion of the relative roles of the state and civil society in decision-making. I will not make any initial assumptions about whether the policy process considered here should take place wholly or partially within the state, or outside the state in the realm of civil society. One of the objectives of the chapter is to determine which elements of an integral policy process should be state-based and which should operate in opposition to the state.

In Section 8.2, I outline guiding principles for an integral policy process. These principles draw on the findings of earlier chapters, particularly the outline of integral theory in Chapter 2. They assist the selection, modification and design of the elements of an integral policy process.

In Section 8.3, I discuss the first element of an integral policy process – integrated assessment. I introduced integrated assessment in Section 4.12.1 and concluded that it is an approach that shows promise as a way of integrating developmental lines in the objective quadrants. Here, I will consider how integrated assessment of climate change has been and might be employed in Australia. I will also address some systemic and process issues that are critical to effective implementation of integrated assessment within an integral framework.

In Section 8.4, I propose a participatory model for linking objectivity and subjectivity within an integral policy process. The participatory model draws on normative futures work, theories of deliberative democracy (particularly Dryzek's (2000) discursive democracy), participatory approaches to integrated assessment and integral theory. It is a modification of the cooperative discourse model of public participation proposed by Renn et al (1993).

In Section 8.5, I consider the developmental task for climate change response from the perspective of each quadrant. Climate change response needs to promote particular kinds of development in the behavioural, systemic, psychological and cultural quadrants. This section explores the nature of the required development and proposes policies that are consistent with that development.

Finally, in Section 8.6, I conclude with a summary of the proposed integral policy response to climate change.

8.2 Principles for an integral policy process

In this section, I draw on previous chapters to propose principles for an integral policy process. These can be thought of as design principles for evaluating, selecting and modifying elements of policy processes that might be suitable for inclusion in an integral policy process. I have applied these principles to the various policy elements reviewed in earlier chapters to design the integral policy process proposed in this chapter.

First, an integral policy process must integrate knowledge from all quadrants. It is a foundational tenet of integral theory that there are four ways of constructing reality – behavioural, systemic, psychological and cultural – and that each of these perspectives provides valid insights.[64] Thus, an integral policy process must find ways to consider and give equal weight to each of these four perspectives.[65] In Chapter 5, I found that Australian energy and greenhouse policy practices are overly reliant on tools, methods and solutions associated with the systemic quadrant. While the academic literature on energy and climate change spans the quadrants, important work on the psychological and cultural aspects of climate change response has not influenced Australian policy practice. This means that, in practice, the above principle requires the expansion of existing policy practices to include methods that access the subjective quadrants. I propose several such methods in this chapter, including integrated assessment, the cooperative discourse model, discursive democracy and community cultural development.

Second, an integral policy process must give adequate attention to multiple developmental lines within each quadrant. At present, as discussed in Chapter 5, Australian policy processes and outcomes favour technological responses to climate change and policies that promote economic growth and development. That is, within the systemic quadrant, current policy processes give

[64] This last claim draws on the principle of enactment, discussed in Section 2.4.3.
[65] This is consistent with the principle of nonexclusion, discussed in Section 2.4.3.

undue attention to technological and economic systems. An integral policy process needs to give more attention to other objective systems, including ecological systems and social and political institutions. I propose integrated assessment as a method that draws on multiple developmental lines in the objective quadrants. I also consider multiple developmental lines in the methods proposed to access the subjective quadrants, listed above.

Third, the inclusion of methods addressing multiple quadrants and developmental lines must be limited by the condition that these methods are applied in a way that is approved as valid by the epistemic community associated with that quadrant and line.[66] In practice, this is a requirement for transparency of policy assumptions to allow peer review of policy input. Robèrt et al (2002, p.202) provide additional support for a democratic principle of transparency as part of their systems framework for sustainable development. In each of the proposed elements of an integral policy process, I attempt to explicitly include transparent peer review processes to address this principle.

Fourth, an integral policy process must include actors that are representative of discursive plurality. As discussed in Chapter 7, this is a normative commitment not only of integral theory, but also of many theories of deliberative democracy (e.g. Dryzek's (2000) discursive democracy) and of grid-group cultural theory. At present in Australia, a resource-based discourse coalition effectively excludes other discourses from authentic participation in the development of energy and greenhouse policy. In Section 8.4, I develop a participatory model designed to include plural discourses and encourage creative contestation and deliberation.

Fifth, an integral policy process must consciously adopt a developmental or evolutionary perspective.[67] It is another foundational tenet of integral theory that reality is composed of holons that develop through creative additions to existing structures. An integral policy process needs to facilitate development across all quadrants. In Chapters 3 and 4, I found that a developmental perspective was sometimes evident in the objective literature, but was rare for literature addressing the subjective quadrants. A developmental perspective was even less common in the Australian policy practices reviewed in Chapter 5. In the objective quadrants, adoption of a developmental perspective means prioritising adaptive technologies, markets and institutions. In the subjective quadrants, it means providing opportunities for individual and cultural development towards greater inclusion. In all quadrants, it means working to creatively transcend existing structures and methods. In Section 8.5, I explore policy approaches that can promote objective and subjective development.

Finally, and related to the previous principle, an integral policy process should endeavour to build on existing policy processes where appropriate. This principle is prompted by an understanding of development as a process that creatively builds on existing structures. Successful policy processes

[66] This is another aspect of the principle of nonexclusion, discussed in Section 2.4.3.
[67] This is the principle of unfoldment, discussed in Section 2.4.3.

should be taken up into an integral policy process that builds on existing strengths. Of course, where there are fundamental problems with existing policy processes, they may need to be abandoned. This is the nature of development. In the next section, I consider the way in which existing Australian applications of integrated assessment might be retained within a broader integrated assessment framework.

8.3 Integrated assessment: broadening objectivity

In Section 4.12.1, I identified integrated assessment of climate change as a promising platform for integrating multiple developmental lines from the objective quadrants, with some potential to expand into the subjective quadrants. As noted in that section, integrated assessment (IA) is a branch of sustainability science that attempts to draw together and coherently synthesise information from a wide range of disciplines to meet the needs of policy and decision makers and provide insights that would not be apparent from any single disciplinary perspective. Given the complexity of ecological and social systems, IA typically relies on 'modern information technology, especially computer modelling' to provide meaningful feedback for policy development (Kasemir et al 2003b, p.xxiii).

Advanced IA models[68] analyse physical, ecological, technological, economic and social systems (including demographic, political and behavioural scenarios), thus integrating most of the developmental lines from the systemic quadrant that are of interest for climate change response. Some of the most advanced IA work[69] introduces subjectivity to computer modelling and scientific assessment work (e.g. Kasemir et al 2003b; Robinson 2003; Schneider 1997). This work has sought to develop IA as a post-normal science by introducing public participation and extended peer review to modelling and assessment approaches. I will examine the role of subjectivity in IA in Section 8.4. Here, I will concentrate primarily on objective issues that need to be addressed in any application of IA.

In the climate science and policy literature, IA refers primarily to the refinement, linkage and application of sophisticated computer models of those elements of natural and human systems that are relevant to climate change. I work with a broader conception of IA here that includes expert judgement and qualitative scenario development alongside the application of quantitative models of varying degrees of sophistication. That is, I define IA as any process that seeks to integrate expert knowledge from the objective quadrants in a policy-relevant form. This broader definition recognises that the tools required by policy makers will vary with the nature of the policy problem. In many energy and greenhouse policy applications, expert scenarios drawing on limited modelling may offer a more cost-effective, flexible and time-responsive method for integration of objective

[68] For example, the fourth-generation models identified by Schneider (1997).
[69] For example, the fifth-generation models identified by Schneider (1997).

developmental lines than the development and application of sophisticated and comprehensive IA models.

In Section 8.3.1, I will consider existing applications of IA to energy and climate policy in Australia and identify applications that are suitable for inclusion in an integral policy process. In Section 8.3.2, I will outline content issues for IA emerging from my earlier review of literature addressing each of the developmental lines in the objective quadrants. Finally, in Section 8.3.3, I will introduce some process issues for consideration in IA; these issues will be taken up in more detail in later sections.

8.3.1 Integrated assessment in Australia

Integrated assessment has been widely employed internationally, particularly in Europe, as a research tool for exploring climate change impacts and climate policy options. Examples include the Integrated Assessment of Climate Protection Strategies (Toth 2003), the ULYSSES project sponsored by the European Commission (Kasemir et al 2003b), the VISIONS project investigating a sustainable Europe (Rotmans et al 2000) and the Dutch Climate Options for the Long Term (COOL) project (Tuinstra et al 2003). In general, these IA approaches were located outside the state but had the objective of providing information, scenarios and models to support decision-makers within the state. They are complex modelling exercises, operating from regional to global scales, and involving dialogue with multiple stakeholders and, in some cases, citizens.

In Australia, there have not yet been any comparable IA projects focusing on energy or climate policy issues. However, the AGO is collaboratively pursuing IA as part of the Australian Greenhouse Science Program (AGO 2003a). Specifically, the AGO is investigating climate change impacts, vulnerability and adaptation through 'integrated regional approaches which link biophysical and socio-economic analysis and modelling, climate change scenarios, costing methodologies, risk management guidance, and guidelines on integrated assessments' (AGO 2003a, p.16).

The AGO recently commissioned a scoping study for a regional IA of climate change impacts and adaptation, focusing on the Cairns and Great Barrier Reef region (AGO 2004a). This study was the first of its kind for Australia and involved more than 150 stakeholders from the region. The study recommended the establishment of a Steering Committee, with members drawn from industry, the community, government, the CSIRO, universities and research institutes, to oversee an integrated regional assessment of climate change. The study drew on a framework for integrated regional assessment of global climate change developed by the Center for Integrated Regional Assessment (CIRA 2004). From an integral perspective, the CIRA framework is comprehensive in its consideration of the objective quadrants, covering human activities (i.e. behaviour), ecosystem health and biophysical impacts (i.e. ecological systems), energy and industry (i.e. technological systems), economic and social consequences and policy changes (i.e. institutional change), across regional, national and global scales. Regional IAs based on this framework would certainly provide useful objective data for an integral policy process, assuming implementation matches the vision in the framework.

If the proposed IA of the Cairns and Great Barrier Reef region proceeds, it will build knowledge and expertise in regional IA that could be applied in other biogeographic regions of Australia considered particularly vulnerable to climate change, including alpine areas, rangelands and tropical rainforests. A national IA, following a similar method, could draw together regional results and identify any additional regions requiring detailed IA. Objective data, quantitative scenarios and models emerging from the regional and national IAs would be a suitable input to an integral policy process. A limitation of the regional IA approach adopted in the AGO scoping study was its focus on stakeholder participation and exclusion of citizen participation. I will consider the relative roles of stakeholders and citizens in an IA process in Section 8.4.

According to the broad definition of IA adopted above, the *Turbulent World* scenarios prepared by NIEIR et al (2003) for the Ministerial Council on Energy (see Section 5.3.4) are also a form of IA. These exploratory scenarios sought to integrate technological and economic considerations, with some attention to ecological, social, political and cultural considerations. Despite the specific limitations of the *Turbulent World* scenarios discussed in Section 5.6, exploratory scenarios in general are valuable for providing a map of the future territory that must be addressed in policy decisions. Exploratory scenarios can be derived from the comprehensive IA models discussed above. However, they can also draw on expert judgement and more limited modelling, as was the case for the *Turbulent World* scenarios. In fact, expert judgement is part of any IA process, guiding the assumptions used in complex IA models as well as the decisions made in qualitative scenario building. I will consider the role of experts in IA in more detail in Section 8.4.

A third type of IA, furthest from the model-based version that is prevalent in the climate change literature, is a qualitative form of IA conducted through public inquiries, independent reviews, stakeholder submissions, bureaucratic deliberation and expert panels. As discussed in Sections 5.3.5 and 5.3.6, public inquiries, reviews and submission processes provide the main opportunity for public participation in energy and greenhouse policy in Australia. Expert and stakeholder submissions to these processes provide knowledge about the objective quadrants, which is combined with knowledge generated within government bureaucracies and qualitatively integrated by review panels or bureaucrats in reports. In practice, it is this type of qualitative IA that dominates existing policy processes in Australia. It may draw on model results and scenarios generated by other processes, such as those described above, but these are only inputs to a broader integrative process driven by state imperatives. In Section 8.4, I will propose a model that seeks to introduce theoretical grounding and discursive contestation into existing processes of qualitative

IA. In the next section, I will outline some content issues that need to be addressed if IA is to be consistent with an integral policy process.

8.3.2 Content issues for integrated assessment

The primary role of an IA in an integral policy process is to assemble and integrate comprehensive knowledge of the objective quadrants as an accessible resource for policy makers. My review of energy and climate change literature in Chapter 3 identified the objective knowledge of most interest for climate change response, including empirical evidence for climate change, observations of human energy-consuming behaviours, biological theories of energy consumption and the respective roles of technological, ecological, economic and institutional systems in facilitating or inhibiting climate change response. All of this knowledge needs to be included, in a policy-relevant form, in an integral climate change response. In the sections below, I will outline specific issues that need to be considered when including each of these types of knowledge in an integral policy process, whether through an IA model, a scenario development exercise or a public inquiry.

Empirical observations and projections of climate change

Empirical observation of linked natural and social systems is crucial for calibration of general circulation models, IA models and other tools used by climate scientists to investigate climate change and develop climate projections. Observation of the physical changes already wrought by climate change is also crucial to allow reflexive changes in scientific and political assumptions and, perhaps, reassessment of the urgency of climate change response. Many important climate model inputs and outputs remain very uncertain and further empirical work to improve the state of knowledge is critical. An example is **climate sensitivity** – the global mean temperature change resulting from a doubling of atmospheric CO_2, currently estimated at 1.5 to 4.5°C (IPCC 2004). The location of the actual climate sensitivity within this range is an important determinant of the urgency of climate change response. While the complexity of natural and social systems, and the intentionality of human systems, means that uncertainty will always be a feature of climate policy decisions, scientific methods can reduce uncertainty in many areas critical to decision-making.

Despite criticisms of the IPCC assessment process (e.g. for failing to integrate climate change response with sustainable development concerns), it has largely succeeded in synthesising diverse empirical data on the changing climate as a key reference for policy makers. Further, the IPCC has shown a capacity for organisational learning and development (see Section 4.7.2) that is consistent with an integral approach. In Australia, scientists from the CSIRO's Atmospheric Research division have ably interpreted the IPCC's assessments and used them to develop Australian climate scenarios and projections. An integral climate change response would continue to draw on the empirical scientific work assembled by the IPCC and CSIRO to plan climate change mitigation and adaptation responses. A priority for an integral policy process is the regionalisation of information on climate change impacts, adaptation and mitigation; as noted above, the AGO is already pursuing a suitable regional approach.

Observations of human behaviour

Empirical observations of actual human behaviour should also be an input to any integral policy process. As discussed in Section 3.3.4, academic models of human behaviour are starting to take into account psychological, social and cultural factors, providing more sophisticated explanations of human behaviour than those provided by neoclassical economic theory. However, the neoclassical model of human behaviour as rational utility maximisation remains dominant in the economic models that support Australian energy and greenhouse policy decisions. One of the most significant criticisms of these models is their removal from empirical reality. Humans behave in unpredictable ways; individual behaviour does not always comply even with the claims made by that individual (Blake 1999), let alone the broader claims of theoretical models. Deviations of actual behaviour from modelled behaviour may significantly reduce the effectiveness of climate change response.

To improve policy effectiveness, policy approaches need to be evaluated through observations of actual post-implementation behaviour. This implies adoption of staged implementation, starting with a small-scale pilot or trial of any new program, followed by reflexive evaluation and refinement of the policy drawing on empirical observation, and finally moving to full-scale implementation where appropriate. This reflexive approach to policy implementation is consistent with the developmental focus of integral theory and is considered in more detail in Section 8.5.

In advocating empirical observation of human behaviour, I am not necessarily contemplating direct observation of people by a researcher or through video footage; such observations may be useful in certain circumstances but are intrusive and raise privacy issues. For most policy programs in the energy sector, data from interval meters or other smart meters will provide sufficient information on actual behaviour. Behaviour logs completed by participants in policy evaluation could be used to supplement metering data. The specific method is less important than the commitment to work with actual behaviour as well as modelled behaviour in an IA framework.

Ecological sustainability

The sustainability of ecological systems is a central concern of this thesis. As discussed in Chapters 1 and 2, sustainable development theory, systems theory and integral theory all agree that human civilisation and culture (the noosphere) relies on a functioning biosphere for its continued existence. Further, in Chapter 1, I discussed ethical arguments for protecting even those ecological systems that may not be crucial to human survival; I support these arguments. Climate change threatens the sustainability of ecological systems. Some irreplaceable ecological systems, such as coral reef ecosystems, are at risk even from gradual climate change. Sustained warming above 1°C is expected to cause annual coral bleaching in most oceans and likely permanent loss of coral reefs

(O'Neill & Oppenheimer 2002). Other ecosystems are able to adapt to gradual climate change but are still threatened by the risk of abrupt climate change and other climate surprises. The risks of abrupt climate change and of specified degrees and rates of gradual climate change remain uncertain.

Faced with the uncertainty of the ecological impacts of climate change, risk evaluation and management approaches have emerged as appropriate tools for developing climate policy (e.g. Jones 2001; Willows & Connell 2003). A risk assessment framework is applied throughout the second volume of the IPCC's TAR, on impacts, adaptation and vulnerability (IPCC 2001a, p.79). Without an understanding of the risk of particular ecological outcomes, the selection of an appropriate atmospheric stabilisation target and associated GHG emission targets becomes exceedingly difficult. Thus, for IA to be policy-relevant, a risk assessment and management framework for ecological impacts is critical.

Klinke and Renn (2002) propose a promising risk evaluation and management framework that is related to the cooperative discourse model of public participation introduced in Section 4.11.3. The authors identify six classes of risk, two of which are relevant to climate change. The first are risks for which the probability of occurrence and the extent of damage are uncertain, including 'risks associated with the probability of sudden nonlinear climate changes, such as the risk of self-reinforcing global warming or of the instability of the West Antarctic ice sheet' (Klinke & Renn 2002, p.1081). The second are risks for which 'the probability of occurrence as well as the extent of damage are high and relatively well known, but there is a considerable delay between the triggering event and the occurrence of damage' (Klinke & Renn 2002, p.1081). Climate change is a risk of this type. Klinke and Renn (2002, p.1087) argue that the first type of risk demands the application of precautionary strategies in response to high uncertainty, whereas the second type of risk requires 'discursive management strategies for building trustworthiness, social consent, and public confidence. These two responses are integrated in the cooperative discourse model, which I will consider in more detail in Section 8.4. Here, I want briefly to consider an important implication for IA of a precautionary approach to ecological impacts.

I argued in Section 3.6.2 that the choice of an appropriate atmospheric GHG stabilisation target is a subjective one that depends on individual values and assessments of acceptable risk. This means that each person will have a different view about the stabilisation target that is consistent with a precautionary approach. In an integral policy process that seeks to include these diverse views, IA needs to present a range of stabilisation scenarios that cover the main value positions. In other words, the choice of an appropriate stabilisation target properly occurs within the policy process, rather than within the modelling process. In this light, it is disturbing that many of the stabilisation scenarios reviewed by the IPCC in the TAR did not consider stabilisation of CO_2 concentrations below 550-ppmv by 2100 (IPCC 2001b, p.148). I argued in Section 3.6.2 that stabilisation of CO_2 concentrations at 450-ppmv is an appropriate target to limit damage to natural and human systems.

A 450-ppmv target would probably not protect coral reef ecosystems from bleaching, but it would probably prevent disintegration of the West Antarctic ice sheet or breakdown of the ocean's thermohaline circulation (O'Neill & Oppenheimer 2002). In an integral policy process, it would be appropriate to at least consider the implications of stabilisation at 450-ppmv – some argue for even lower targets.

Technology policy

In Section 3.5.4, I discussed technological lock-in or, as it manifests within the existing energy system, carbon lock-in. The lock-in of existing fossil fuel technologies means that policy intervention is necessary to initiate and sustain a transition to more sustainable energy technologies. Policy intervention can take many forms. The direct and indirect energy and transport subsidies examined in Chapter 6 are one type of policy intervention. Although Australian subsidies currently favour fossil fuels over renewable energy, removal of existing subsidies and expansion of renewable energy support programs could reverse this situation. Another type of policy intervention is strategic niche management, which provides a way of using niches where alternative technologies are economically competitive to achieve technological learning and improve the mainstream competitiveness of the technology (e.g. Hoogma et al 2002). This approach draws on insights provided by experience curves, which demonstrate that technology cost falls as a function of experience.

One of the roles of an integral policy process is to determine what type of policy intervention is appropriate to guide and support technological development. However, there is a consensus amongst those who accept the need for climate change response that the objective of any such policy intervention should be to develop mainstream cost-effective applications of low-carbon technologies to replace existing fossil fuel technologies.[70] The implication of this objective is that any IA process must address technological change. It will not be adequate to rely on energy projections that simply carry the existing state of carbon lock-in into the future. This implies use of exploratory scenarios or narratives that present multiple technological pathways to decision makers (Kay et al 1999).

It is not possible to specify in advance the mix of low-carbon technologies that will provide the eventual response to climate change. Candidate technologies include efficient energy technologies, natural gas substitution, carbon dioxide capture and storage, nuclear fission and fusion, wind power, hydroelectricity, biomass power, biomass fuels, solar thermal technologies, photovoltaic power, wave and tidal power, artificial photosynthesis and various hydrogen generation and utilisation technologies. Each of these technologies has limitations and risks. Some may never be technically or economically viable, some can only deliver a portion of the emission reductions required to stabilise the climate and some have levels of risk that the public is unwilling to accept.

[70] This consensus does not extend to the choice of preferred low-carbon technologies to support.

In Chapter 5, I discussed the Australian Government's strong support for carbon dioxide capture and storage technologies as its primary long-term climate change response policy. Reliance on a specific unproven technology is risky in an uncertain world. It would be wiser to pursue a portfolio approach that spreads available research, development and commercialisation funds across several promising technological options, rather than relying predominantly on any particular option. Again, it is the role of an integral policy process to determine which technologies to support. Any IA process needs initially to provide information about multiple technologies; participants in an integral policy process may immediately reject some technologies, so an iterative approach that presents information sufficient for technological screening before conducting detailed modelling of technologies is appropriate.

If the energy system is to be sustainable in the long-term it must comply with certain system conditions, evident from ecology, systems theory and the laws of thermodynamics (and supported by integral theory). As discussed in Section 1.4.3, Robèrt et al (2002, pp.198-199) provide an outline of these system conditions. The system conditions indicate that an ecologically sustainable energy system would be completely reliant on renewable energy flows, use renewable materials for the physical infrastructure of the system where possible and integrate with closed-loop industrial systems that reuse or recycle any non-renewable materials. Further, it would have no outputs that accumulate in the environment (such as GHG emissions). Finally, it would avoid degrading the natural systems that it interacts with by prioritising small-scale technologies and applying the work of industrial ecologists and ecological designers that seek to integrate technological and ecological systems (e.g. Benyus 1997; McDonough & Braungart 2002; Robèrt et al 2002; van der Ryn & Cowan 1996).

As a normative ideal, these conditions are challenging and perhaps unattainable. However, they do provide guidance on preferred energy system technologies for participants in an integral policy process. Technologies that improve energy efficiency are particularly attractive, as they reduce the scale of the energy system (see Section 3.5.2) and consequently reduce extraction from the environment, waste to the environment and environmental degradation. Clearly, renewable energy is preferable to fossil fuel energy because it draws on renewable flows of energy and materials and therefore requires less extraction from the environment and creates less environmental degradation.

The role of economic analysis

In earlier chapters, I have criticised economic analysis of climate change response at length. My criticisms relate to unconsidered assumptions and value commitments, reduction of complex positive and negative impacts to quantitative changes in monetary values, exclusion of important costs and benefits, an ideological commitment to economic growth and over-reliance on economic methods and tools to the exclusion of other important perspectives in decision-making. In general, these criticisms relate to the failure of economic analysts to contextualise economic development as one of many developmental lines in the systemic quadrant and to recognise the desire for material wealth and economic growth as a non-universal value. Despite these criticisms, when employed within appropriate constraints, economic analysis and modelling is an important part of an integral policy process.

One important constraint is that conventional quantitative economic models and cost-benefit analyses should not be used to identify climate policy objectives. I believe this constraint needs to be imposed because it is impossible to accurately quantify climate change impacts and therefore impossible to prepare a complete comparison of the costs and benefits of climate policy. Policy objectives, such as GHG emission reduction targets, are appropriately determined through political and social processes that engage subjective values, such as an integral policy process. This approach is supported by Van den Bergh (2004) who, as noted in Section 3.7.2, advocates qualitative rather than quantitative cost-benefit analysis to select policy strategies. Van den Bergh notes that the maximum cost of climate change is far higher than the maximum cost of climate change response, draws attention to the irrevocability of climate catastrophes and concludes that a precautionary climate change response is clearly justified without any need to resort to quantitative cost-benefit analysis.

However, this approach avoids difficult questions about the timing of climate change response. Without some form of quantitative economic analysis, it is difficult to determine whether the long-term benefits of a specific climate change response outweigh the short-term hardship that might be imposed. In Section 3.7.2, I introduced an exploratory scenario-based economic modelling approach (Lempert & Schlesinger 2000; Lempert et al 2000) that addresses this problem. Recognising that the results of a cost-benefit analysis are sensitive to the assumptions, exploratory modellers create a large ensemble of future scenarios based on different assumptions and conduct multiple, quantitative, cost-benefit analyses of the performance of alternative policy strategies across this range of plausible futures. The modellers then use computer search and visualisation techniques to identify policy strategies that are robust across the range of plausible futures. This type of approach, drawing on exploratory scenarios, is an appropriate way to include quantitative economic analysis in an integral policy process.

Once an integral policy process has allowed agreement to be reached on political objectives, quantitative economic analysis has an important role in identifying the least cost allocation of resources to achieve those objectives. In Section 4.12.2, I discussed a method called integrated resource planning, used to identify the least cost options to meet a specified increase in demand for energy services. A similar approach, called integrated abatement planning (IAP), can be applied to identify the least cost abatement options for meeting a specified GHG reduction target. Defining GHG abatement as the resource of interest, the appropriate metric of comparison for different abatement options is the unit abatement cost, in dollars per tonne of avoided GHG emissions.

Expressing the cost of all abatement options in these terms allows fair comparison within the integral policy process.

Of course, the specific methods used to calculate the unit abatement cost are important. As noted in Section 3.7.2, economic models based on equilibrium theory do not perform well in situations of disequilibrium; climate change response clearly qualifies as creating disequilibrium. In Section 8.5, I will consider evolutionary economic models that seem better equipped to deal with disequilibrium. Economic analysis methods would also benefit from inclusion of environmental and social externalities where possible, and a greater degree of public participation in the selection of modelling assumptions and estimation of costs and benefits. In Section 8.4, I will discuss a technique called deliberative valuation that introduces discursive contestation to existing non-market valuation methods used to include environmental and social externalities.

Social and political institutions

From a social and political perspective, IA needs to consider anticipated demographic changes, alternative policy strategies for climate change response and the social impacts of both climate change and climate change response. Adequate consideration of these issues requires participation in IA by sociologists, political scientists and other social scientists. Further, analysis cannot be limited to national institutions; consideration must be given to how international institutions might develop in the future. In practice, one way to address this requirement is to develop exploratory global scenarios that capture the main alternative global policy frameworks that might emerge in the future. This approach was evident in the *Turbulent World* scenarios and is part of the regional IA framework discussed in Section 8.3.1.

There is an extensive literature on alternative global frameworks for climate change response that can be used to develop global policy scenarios. I cited some examples of this literature in Section 3.8.1. For example, Aldy, Barrett and Stavins (2003) analyse fourteen global climate policy architectures, including the Kyoto Protocol. In practice, it should be possible to represent the many possible global climate policy frameworks using a small number of categories that impact on domestic policy, such as whether or not there is full participation by all countries, whether GHG reductions are deep or shallow and whether there are equal per capita targets, differentiated targets or targets linked to economic productivity.

In addressing social impacts, the risk evaluation and management framework proposed by Klinke and Renn (2002) and discussed above is applicable. In addition, I cited another risk management framework in Section 3.7.2, presented by Parry et al (2001), that quantifies the millions of people at risk from climate change. This is a powerful framework for introducing the scale of the human tragedy of climate change to an integral policy process. It makes it abundantly clear that decisions about domestic climate change action have serious global consequences for a multitude of people.

8.3.3 Process issues for integrated assessment

In addition to the content issues discussed in Section 8.3.2, there are some process issues to consider if IA is to be included in an integral policy process. First, consistent with one of the integral policy principles outlined in Section 8.2, any IA process must include provision for independent peer review. To support peer review, the IA process must transparently document modelling assumptions, methods, the participatory design and decision-making procedures.[71] For regional IA of the type proposed by the AGO, the Steering Committee could support an independent peer review function. It does not appear that the *Turbulent World* scenarios were subject to independent peer review from outside the MCE or the consultant group before release. However, the extensive documentation of the scenarios and the scenario development process at least allows for post-release peer review. In the qualitative IA that dominates real policy processes, opportunities for peer review vary; there are usually opportunities to comment on draft reports, however, many aspects of the decision-making process are not transparent. In Section 8.4, I will consider how transparency and peer review can be made explicit in an integral policy process.

Second, it is clear that if IA is to be consistent with an integral policy process it needs to be conducted by an interdisciplinary team with expertise across all of the developmental lines considered in Section 8.3.2. Exclusion of particular disciplines compromises the results of the policy process by ignoring important perspectives. For example, in the *Turbulent World* scenarios, the exclusion of social science expertise from the consultant team was notable and was reflected in the scenario outcomes. The principle of enactment, from integral methodological pluralism, implies that an integral policy process needs to give voice to expertise operating from all quadrants, developmental lines and waves of consciousness. In Section 8.4, I will consider the role of expertise in an integral policy process in more detail.

Third, ensuring that knowledge from multiple developmental lines is available does not ensure integration. Integral theory provides some guidance for knowledge integration. For example, since the noosphere ultimately relies on the health of the biosphere, it is reasonable to give a high priority to ecological information and policies that preserve healthy ecological systems. The principle of unfoldment, from integral methodological pluralism, points to the need for integral process facilitation; an integral facilitator recognises the structures of consciousness associated with particular knowledge positions and can integrate them developmentally. I will consider this facilitation role in Section 8.4.

Finally, an IA process can occur within the state or outside the state (in civil society). Dryzek (2000) argues that inclusion within the state does not necessarily lead to more democratic outcomes. The regional IA proposed by the AGO would have state support but would retain a significant degree

[71] van Asselt & Rijkens-Klomp (2002) find that, in the specific case of participatory design, current documentation of IA is often inadequate to support peer review and learning.

of independence. This allows research and experimentation that is not always possible within the constraints of a state process. The *Turbulent World* scenarios were commissioned by the state and there were some state constraints on scenario outcomes, however, the consultants retained a degree of freedom to present their own views and those of stakeholders. The qualitative IA process described in Section 8.3.1 occurs very much within the state and is subject to state imperatives. In Section 8.4, I will consider the advantages and disadvantages of state inclusion and attempt to locate an integral policy process in relation to the state and civil society.

8.4 A participatory model for linking the objective and subjective

In Section 8.3, I discussed the role of IA in integrating knowledge from the objective quadrants in a policy-relevant form. However, an integral policy process must also integrate objective and subjective knowledge. In this section, I draw on theories and methods introduced in earlier chapters to propose a participatory model that explicitly links objective and subjective knowledge. The participatory model draws on normative futures work, theories of deliberative democracy (particularly Dryzek's (2000) discursive democracy), participatory IA and integral theory. It is a modification of the cooperative discourse model of public participation proposed by Renn et al (1993).

In Section 8.4.1, I explore policy development as a normative process that draws out subjective values. In Section 8.4.2, I discuss discursive democracy and its implications for an integral policy process. In Section 8.4.3, I outline the cooperative discourse model and propose modifications consistent with the needs of an integral policy process on climate change. In Section 8.4.4, I examine the important role of integral facilitation within the proposed participatory model. Finally, in Section 8.4.5, I locate the participatory model with respect to the state and civil society.

8.4.1 Policy development as a normative process

I introduced normative scenarios in Section 5.3.4. Here, I will investigate in more detail the role of normative methods in linking objectivity and subjectivity. As discussed in Section 8.3, IA draws together knowledge from multiple developmental lines within the objective quadrants as a resource for policy-makers. That knowledge is often presented in the form of exploratory scenarios that map out the future territory relevant to a policy decision. The role of a policy process is then to navigate a desirable path through that future territory. Thus, policy development is a normative process – it seeks to create a desirable future.

The question that immediately arises is "a desirable future for whom?" A policy process may seek to create the desired future of a single authoritarian decision maker, a small group, the citizens of a particular nation, all people living at present or all people including future generations, with many possibilities in between. Thus, the futures created by a particular policy process may be more or less inclusive. An integral policy process seeks to create a future that includes all perspectives. While this may seem to introduce unmanageable complexity to a policy process, my exploration of discourse in Chapter 7 indicated that plural perspectives tend to be expressed through a relatively small number of discourses that can feasibly be included in a policy process. Normative methods – methods that ask participants in a policy process to express their preferred futures – can draw out subjective plurality and aid discourse identification.

Normative methods have a long history in relation to energy sector planning and sustainable development. In 1982, Robinson introduced a normative method called **backcasting** for exploring energy futures (Robinson 1982). Lovins (1977) and the Swedish Secretariat for Futures Studies (Johansson & Steen 1978; Lonnroth, Johansson & Steen 1980) applied similar energy futures methods earlier but did not use the term backcasting. As discussed in Section 2.5.3, backcasting defines a desirable future and works backwards to develop an action plan for achieving that future. Backcasting has been developed in some detail as a method for identifying pathways to desirable futures, including sustainable futures (e.g. Anderson 2002; Dreborg 1996; Geurs & van Wee 2000; Robèrt et al 2002; Robinson 1990, 2003; Saddler, Diesendorf & Denniss 2004; Turton et al 2002).

Backcasting is particularly valuable for application to climate change response in the energy sector because it provides a way to escape the present paralysis of carbon lock-in. It does this by reminding analysts that the purpose of the energy system is ultimately to meet human needs and desires. By focusing attention on what is desirable, instead of what is likely, it encourages identification of trend-breaking policy actions to move away from a situation of lock-in, unlike energy projections that simply carry lock-in forward into the future. As Dreborg (1996, p.819) puts it, backcasting promotes creativity 'by shifting the focus from present conditions to a situation sufficiently far off in the future to permit radical change'. This shift in focus provides space for the subjective commitments of participants in the backcasting process to emerge.

In practice, the research team typically defines the desirable future or futures (Robinson 2003). Further, most applications in the literature identify a single desirable future, expressed in objective terms (e.g. as a GHG emission reduction target), and model objective pathways (mainly technological and economic) between the present and that desirable future. There is rarely any attempt to draw out different discourses or to let participants define desirable futures. Consequently, in most practical applications, the subjective potential of backcasting has not been realised. In recent work, Robinson (2003) has developed a participatory form of backcasting that involves stakeholders or citizens in selection of desirable futures. In the context of a participatory IA called the Georgia Basin Futures Project, Robinson describes the use of computer simulations and workshops to guide participants through an iterative process of scenario generation until they reach their preferred future. This approach integrates individual subjectivity with objective modelling of desirable futures and would seem well suited to an integral policy process.

In addition to computer simulation approaches, an integral policy process could ask participants to express normative futures through discussion, artistic expression and storytelling in the context of scenario development. The intent is not to build a consensus but to draw out different desirable futures and identify corresponding discourse commitments. Scenarios provide focus and rigour for the normative process and are consistent with the goal of drawing out, grouping and expressing subjective positions. As Ney and Thompson (2000, p.77) put it, this type of scenario planning 'deliberately seeks out stories that are mutually irreducible, and…then aims to learn from all the incompatibilities that those stories give rise to'. Objective elements of the different scenarios can be modelled to improve understanding of their implications, providing a link between the objective and subjective. However: 'While quantitative analysis can add insight and consistency, the power of scenarios lies in telling compelling stories that capture the imagination, understanding, and beliefs, hopes and dreams of participants' (Swart, Raskin & Robinson 2004, p.145). In Section 8.4.3, I will examine how normative scenarios can be developed in the context of a specific participatory model.

8.4.2 Discursive democracy

In Section 4.11.4, I discussed deliberative democratic theory and, in particular, the discursive strand of deliberative democracy proposed by Dryzek (2000). Discursive democracy seeks to engage multiple discourses in contestation and deliberation, thereby drawing out subjective values and encouraging reflection. It is a normative ideal, consistent with those expressed by advocates of post-normal science (e.g. Funtowicz & Ravetz 1993), grid-group cultural theory (e.g. Ney & Thompson 2000) and sustainable development (e.g. Robinson 2004). However, it has definite applications for the practical design of participatory processes that have been explored in some detail through trials and empirical evaluations. In this section, I will review deliberative and discursive democracy to identify principles for participatory procedures within an integral policy process.

Dryzek (2000, p.1) defines deliberation as a non-coercive, reflective and pluralistic process, allowing 'argument, rhetoric, humour, emotion, testimony or storytelling, and gossip', through which people arrive at a particular judgement, preference or view. It is an active process though which unconsidered beliefs and values are challenged, encouraging participants to arrive at a defensible position on an issue (Gundersen 1995, pp.11-16). The process of deliberation requires individuals to express their values and preferences and to defend those values and preferences through argument and contestation within a group setting. Thus, an authentic deliberative process draws out both individual subjective positions and collective discourse commitments. This means that an integral policy process can potentially access subjectivity by promoting deliberation. When deliberation considers issues from the objective quadrants, as is the case in most policy processes, it provides a way to integrate the objective and subjective in decision-making.

Deliberative democratic theory defines deliberation, rather than voting or representation, as the essence of democracy. Deliberative democrats seek to promote deliberation in various locations, either within the state or in civil society. Deliberation can occur without citizen or stakeholder participation, for example within a decision-making body like the Ministerial Council on Energy. Alternatively, it can occur within participatory processes that are open to citizen or interest group participation. Based on my discussion of different environmental and climate policy discourses in Chapter 7, I believe that an integral policy process must seek citizen and/or interest group participation to ensure adequate representation of plural discourse perspectives. Further, I am not convinced that interest groups can be relied upon to accurately represent citizen interests. Certainly, there is no guarantee that interest group representation will capture the plural discourse commitments of citizens. I therefore advocate direct citizen participation as crucial to an integral policy process.

How can an integral policy process, involving citizens, promote authentic deliberation and discursive contestation? There are several issues to consider here. The first issue is deliberative competence – the capacity of participants to engage in effective deliberation (Dryzek 2000; Renn 1999). Dryzek (2000) argues that deliberation must be non-coercive, and therefore requires equality of deliberative competence across participants. Unequal power relations and material resources, uneven access to information, differences in communicative abilities and personal characteristics can all contribute to inequalities in deliberative competence. The dominant energy and greenhouse policy role of the resource-based discourse coalition in Australia is an example of inequality of deliberative competence. If an integral policy process is to promote authentic deliberation, it needs strategies to improve equality of deliberative competence.

The first strategy I would suggest is to equalise the knowledge base of citizen and stakeholder participants by providing them with accessible information and education on the policy issue. Renn (1999, p.3050) notes that ‘public perceptions are at least partially driven by biases, anecdotal evidence, false assumptions about dose-effect relationships, and sensation’. While biases and false assumptions can reveal discourse commitments, good policy decisions are not served by reliance on inaccurate information. However, it is unreasonable to expect all participants to master complex climate change issues. Expert involvement in the policy process is necessary to translate complex scientific and policy issues for other participants. Of course, as Renn (1999) points out, experts have their own subjective values and positions, which will also need to be resolved through a process of deliberation. The cooperative discourse model, discussed in Section 8.4.3, offers a way to involve experts and the public in deliberation and dialogue.

A second strategy to improve deliberative competence, suggested by Dryzek (2000), is to allow multiple forms of communication. For example, participants that are uncomfortable with the demands of argumentative communication could employ storytelling to express their preferences. Similarly, participants uncomfortable with verbal communication in a group setting could employ written communication. Dryzek (2000, p.68) discusses two tests that should be applied before admitting any particular form of communication to a discursive democratic forum: 'First, any communication that involves coercion or the threat of coercion should be excluded. Second, any communication that cannot connect the particular to the general should be excluded'. On this basis, Dryzek conditionally accepts storytelling, testimony, greeting, rhetoric and argument as admissible forms of communication, while stressing that each of these has coercive and specific forms that should be excluded.

Other strategies to improve equality of deliberative competence might establish process rules to govern interaction between participants. This provides a link to the second issue I want to consider, which is whether rules of engagement are required to facilitate deliberation. It is one thing to ensure that voices representing plural discourses are present, quite another to ensure constructive engagement, dialogue and mutual understanding. Good facilitation, defusing unproductive conflicts and providing equal opportunities for expression to participants, would seem to be critical to support constructive engagement. I will return to this facilitation role in Section 8.4.4. Beyond a need for facilitation, I do not believe that general rules of engagement are required for deliberation. As Dryzek (2000, p.47) points out: 'Political equality, human integrity, reciprocity, publicity, and accountability are undeniably important values, but the best way for people to learn these values is through the practice of deliberation, rather than through being told'. I concur, although I would also argue that context-specific rules of engagement might be an appropriate response to situations where engagement is not initially constructive.

The third issue is selection of one or more participatory models that seek to promote deliberation for inclusion in an integral policy process. Current forms of participation in Australian energy and greenhouse policy, discussed in Sections 5.3.5 and 5.3.6, are not designed to facilitate deliberation or representative citizen participation. In Section 4.11, I mentioned several participatory designs intended to promote deliberation, including deliberative polls (e.g. Fishkin 1995), citizens' juries (e.g. Carson et al 2002), consensus conferences (e.g. Einsiedel, Jelsoe & Breck 2001) and cooperative discourse approaches (e.g. Renn 1999; Renn et al 1993). All of these have been applied to energy or greenhouse policy issues internationally. Other methods applied in the context of participatory IA include focus groups, participatory scenario analysis, participatory simulation or gaming, participatory modelling, participatory planning and scientist-stakeholder workshops (van Asselt & Rijkens-Klomp 2002). With appropriate implementation, any of these models has the potential to promote deliberation and discursive contestation, thereby introducing plural subjectivity to policy processes. I have chosen one model – the cooperative discourse model – to consider in more detail in the next section. The cooperative discourse model establishes an analytic-deliberative process that explicitly seeks to integrate objective analytical knowledge with discursive values. It is therefore an ideal candidate for an integral policy process.

8.4.3 The cooperative discourse model

In Section 4.11.3, I introduced a cooperative discourse model for involving experts, stakeholders and the public in policy processes, discussed by Renn et al (1993). The cooperative discourse model is an example of an analytic-deliberative process, of the type advocated by Stern and Fineberg (1996). Analytic-deliberative processes 'encompass procedures that are constructed to provide a synthesis of scientific expertise and value orientations' (Klinke & Renn 2002, p.1075). In other words, these processes seek to integrate objective and subjective knowledge within a policy and decision-making context.

More specifically, the cooperative discourse model is designed to address policy issues characterised by complexity, uncertainty and ambiguity by drawing on appropriate types of expertise (Klinke & Renn 2002). I will illustrate this using the example of climate change, which is complex, uncertain and ambiguous. First, the natural and social systems involved in climate change are complex systems. Complex issues demand multidisciplinary deliberation among **experts** to resolve or map cognitive and epistemological conflicts. Second, the future impacts of climate change are uncertain. Uncertain issues require resilient strategies and identification of 'an adequate and fair balance between assumed over- and underprotection' (Klinke & Renn 2002, p.1087). **Stakeholders** and affected groups have a role in determining this balance. Finally, climate change is an ambiguous issue because it is characterised by value conflicts, for example between those who prioritise the national interest and those who prioritise global interests. Ambiguous issues demand **citizen** participation to reconcile value conflicts (Klinke & Renn 2002).

Other authors also support explicit inclusion of experts, stakeholders and citizens in policy processes. Robinson (2003, p.854) identifies a need to 'combine expert understanding with the knowledge, values, and preferences of citizens and stakeholders'. Swart, Raskin & Robinson (2004, p.144) argue, in the context of scenario planning, that: 'Scientists bring knowledge of relevant processes and their linkages to the discourse and stakeholders enrich scenarios by bringing the perspectives of the human participants in the story of the future'. I outlined my own arguments in favour of inclusion of each of these groups, from the perspective of discursive democracy, in Section 8.4.2. The cooperative discourse model includes these different groups and also specifies their appropriate roles.

Figure 8.1 summarises the basic concept of the cooperative discourse model, as outlined by Renn et al (1993) and Renn (1999). There are three main steps:

1. Elicitation of values and criteria (primarily by stakeholders).
2. Assessment of the impacts of different policy options (primarily by experts).
3. Evaluation and design of policies (primarily by randomly selected citizens).

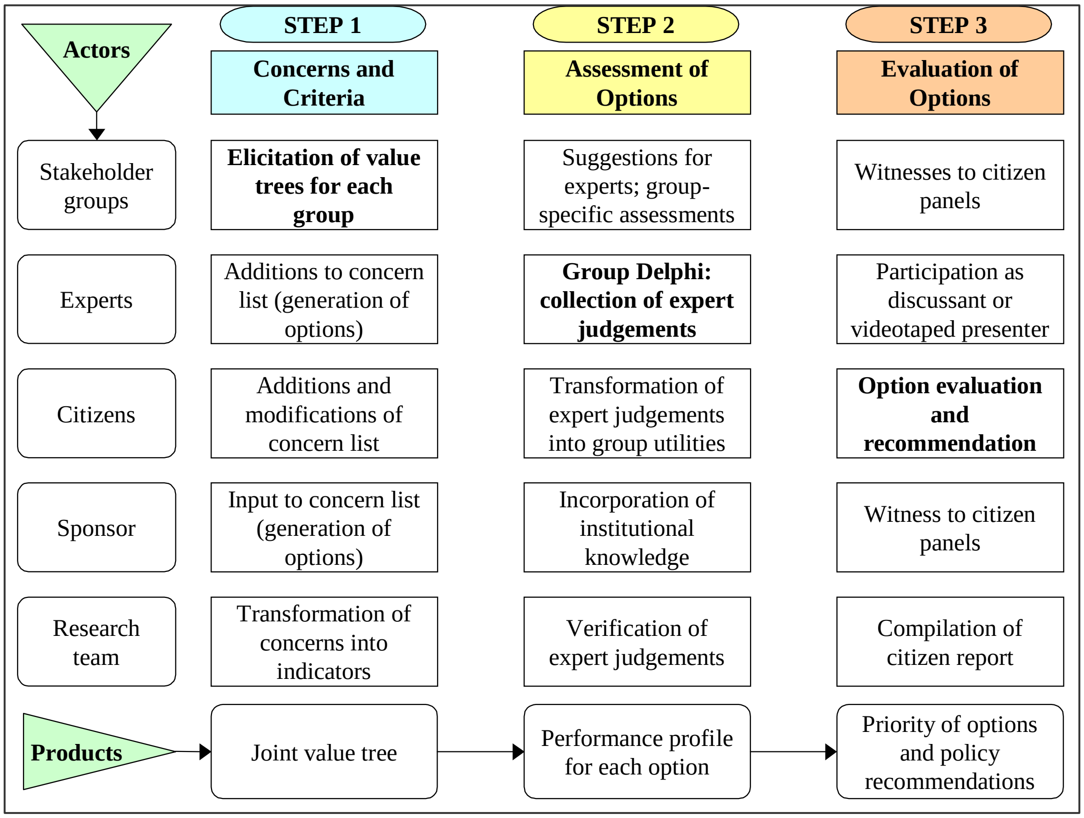

Figure 8.1: Basic concept of the cooperative discourse model.

Source: After Renn (1993, p.3051).

At each step, there is scope for participation from stakeholder groups, experts, citizens, the sponsor of the policy process and a research team. Figure 8.1 defines the roles of each group and appropriate methods, as proposed by Renn et al (1993) and Renn (1999). Carson (1999) adds a fourth step to the cooperative discourse model, focused on accountability and education, in which feedback is provided to the wider community and the entire process is evaluated. Carson (1999) also proposes some modifications to the earlier steps, particularly provision for involving randomly-selected citizens in the selection of values and criteria during Step 1. Carson and Gelber (2001) further modify the model, adding a visioning component to the first step and allowing for a return to Step 1 if citizens are not satisfied with the options available at Step 3.

In the sections below, I will build on the original cooperative discourse model and the modified version proposed by Carson and Gelber (2001) to propose a version of the cooperative discourse model that is consistent with integral theory and suitable for addressing climate change. My modified version of the cooperative discourse model is summarised schematically in Figure 8.2. Although I present each of the steps in the modified model sequentially and allocate specific roles to experts, stakeholders, citizens and the research team (or secretariat) throughout, I envisage the policy process as flexible and context-dependent. In practice, the four steps may not have clear boundaries or may occur simultaneously. Further, the formal process described here would be appropriate for developing a comprehensive energy policy or climate change response. For more specific policy decisions, a more informal process, omitting or condensing certain steps would be appropriate. Indeed, a condensed version of this process could act as the agenda for a brief policy workshop on a specific issue.

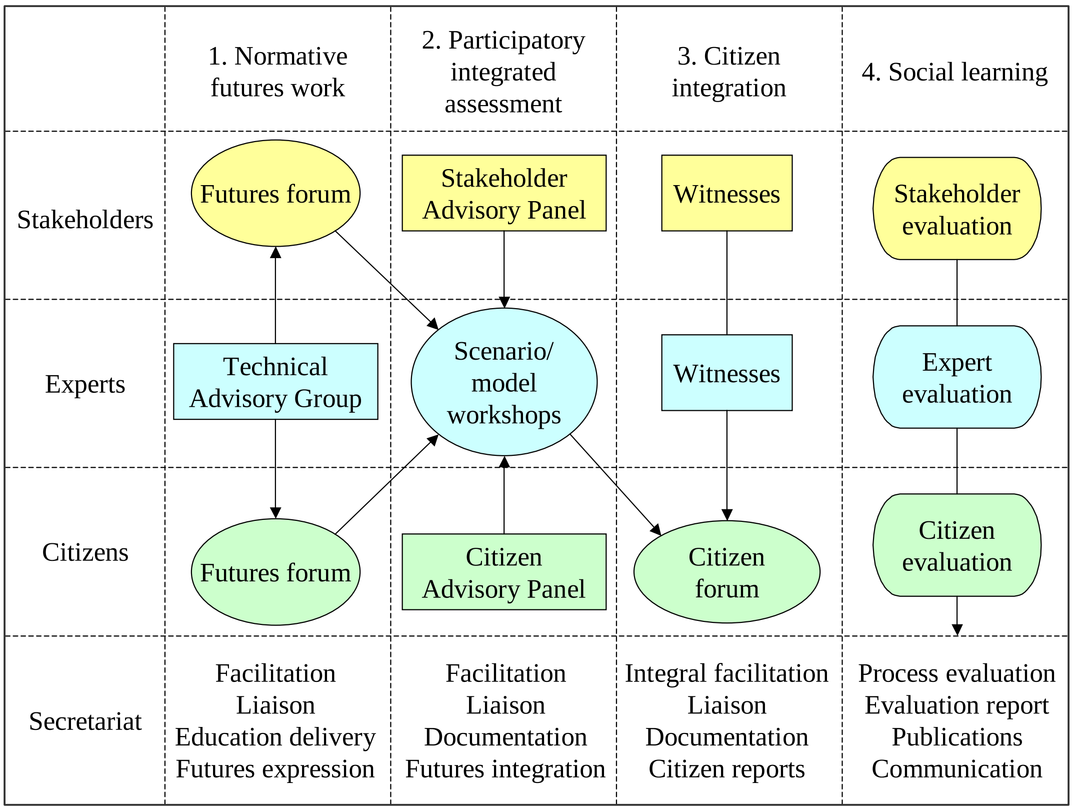

Figure 8.2: A modified version of the cooperative discourse model for an integral policy process.

Step 1: Normative futures work

For Renn (1999), the first step is to identify and select concerns, objectives and evaluative criteria. Renn argues that stakeholder groups have the most appropriate expertise to undertake this step. Stakeholders are 'socially organized groups that are or perceive themselves as being affected by the decision' (Renn 1999, p.3049). They 'are valuable resources for eliciting concerns and developing evaluative criteria since their interests are at stake and they have already made attempts to structure and approach the issue' (Renn et al 1993, p.189). Carson and Gelber (2001) agree that the first step should establish values, goals and criteria for measuring success. However, they also emphasise the role of this step in providing a vision for the process. Further, they propose that randomly selected citizens, rather than stakeholders, should conduct this first step.

I agree with Carson and Gelber (2001) that greater emphasis on visioning is appropriate at this step. In Section 8.4.1, I discussed policy development as a normative process and proposed normative futures work as a way of drawing out the subjective values and discourse commitments of participants. Normative futures work is particularly important for a long-term problem like climate change that engenders markedly different value responses; it becomes the first step in my proposed participatory model. Through the process of expressing desirable futures, participants will necessarily reveal their values, goals and criteria for assessing policy outcomes. As discussed in Section 8.4.1, normative futures work can draw on numerous specific methods, from interactive computer simulation to storytelling to artistic expression. Initially, this process should not seek to develop a single, desirable, consensus future but to draw out the smallest number of alternative futures that capture group values and discourse commitments. Allowing multiple futures to coexist allows plural subjectivity to emerge. I am partly inspired here by Ney and Thompson (2000) – grid-group cultural theorists who advocate scenario planning as a way of drawing out the irreducible stories associated with different discourse positions.

On the question of whether stakeholders or citizens should be involved in this normative futures process, I agree with both Renn et al (1993) and Carson and Gelber (2001). Stakeholders that have already engaged with an issue are well placed to express a desirable future to which they have given considerable thought. Thus, stakeholders are likely to express considered futures that are the product of previous deliberation. On the other hand, as noted in Section 8.4.2, I am not convinced that stakeholder groups will reliably represent wider public interests. Thus, randomly selected citizens are likely to express desirable futures that are more representative of public opinion. Therefore, I propose that both stakeholders and citizens would be involved in normative futures work, in separate processes or roles to avoid problems of unequal deliberative competence.

Both groups would require access to expertise in specific areas to assist their expression of normative futures. The citizen group, in particular, would need to participate in an education program to provide members with a suitable knowledge base on energy and climate changes issues. Thus, experts would need to be convened as an advisory group in the first step. This advisory group would have an initial role in contributing to information and educational materials and providing advice on questions that arise.

A research team or secretariat would be responsible for process facilitation and liaison between groups. The secretariat would also need to express each of the normative futures that emerge in a format suitable for use in the remainder of the process. This might include a narrative description of the future and the values associated with that future, objectives embodied in that future and evaluative criteria for determining consistency of a specific policy proposal with that future. The main objective of this first step is to draw out different discourse commitments, without necessarily promoting significant engagement across discourses.

Step 2: Participatory integrated assessment

For Renn (1999), the purpose of the second step is to identify and measure impacts and consequences related to different policy options. Renn et al (1993, p.189) argue that this is the role of experts: 'Experts are necessary to provide the data base and the functional relationships between options and impacts'. Renn et al (1993) discuss the use of a Group Delphi exercise at this step, in which a representative group of experts from the field engages in dialogue and confrontation to arrive at a consensus performance profile for each policy option. The performance profile 'specifies the range of scientifically legitimate and defensible expert judgments' for each option, allowing diverging opinions to be captured (Renn et al 1993, p.191). Carson and Gelber (2001) do not modify this step substantially. They emphasise the need to develop an action plan or an evaluated list of options consistent with the knowledge generated in Step 1, but leave the methods used by the expert panel open.

In my model, this step becomes participatory integrated assessment. As discussed at length in Section 8.3, IA is the process of drawing together and integrating objective knowledge in a policy-relevant form. In that section, I outlined the developmental lines from the objective quadrants that need to be synthesised in an IA and discussed some of the methods used, including sophisticated IA models, exploratory scenario building and qualitative IA. The appropriate group to conduct an IA is an interdisciplinary team with expertise spanning the quadrants and relevant developmental lines. However, although the complexity of IA requires expert involvement, I do not believe that this step should be solely expert-driven. Rather, I propose the application of participatory IA, involving stakeholders and citizens in modelling processes and decisions.

Public participation in IA is required as it is not possible to model human 'intentionality and freedom of will' (Kasemir et al 2003b, p.xxiii). Models need to be developed in dialogue with citizens and stakeholders (Kasemir et al 2003b). Participatory IA is emerging as the preferred approach to IA of climate change internationally, given the need to address uncertainty and ambiguity through subjective decisions. Of the IA projects cited in Section 8.3.1, the ULYSSES project (Kasemir et al 2003b), the VISIONS project (Rotmans et al 2000) and the COOL project (Tuinstra et al 2003) all focused strongly on promoting participation in IA. The Georgia Basin Futures Project (Robinson 2003) cited in Section 8.4.1 is another example of participatory IA. All of these projects try to improve the quality of IA by engaging participants in the analytical processes and decisions. Whereas in Step 1 experts acted as advisors to citizen and stakeholder deliberations, in Step 2 citizens and stakeholders act as advisors to expert deliberations.

For example, modellers could convene a citizens' panel or citizens' jury to deliberate on specific modelling issues that have important implications for scenario outcomes. This approach is termed **participatory modelling** (van Asselt & Rijkens-Klomp 2002). Similarly, economists could convene a citizens' panel to deliberate on appropriate values for non-market costs and benefits associated with climate change or climate change response. This approach is termed **deliberative valuation** or deliberative non-market valuation (e.g. Jacobs 1997; Söderholm 2001). Where other non-market valuation methods, like contingent valuation or choice modelling, ask individuals to report their private preferences for environmental goods (as willingness to pay), deliberative valuation asks groups of citizens to deliberate on the public value of an environmental good. The intent is that deliberation will provide a better approximation of the public interest than the elicitation and aggregation of private preferences. These are just two examples of how participatory IA might work in practice; specific participatory IA projects have experimented with a range of other methods that could be drawn on as appropriate (e.g. Kasemir et al 2003b; van Asselt & Rijkens-Klomp 2002).

The participatory IA step proposed here has four objectives. The first is to develop exploratory scenarios mapping out the relevant future territory as a resource for the policy process. I leave the development of exploratory scenarios to Step 2 to avoid prejudicing the range of desirable futures to emerge from Step 1. The second objective is to evaluate each of the normative futures from Step 1 against the exploratory scenarios and determine their feasibility. The third objective is to develop policy options for achieving each of the feasible futures and evaluate their economic, ecological and social impacts. For futures that are not feasible, the objective is to provide explanations of why the future is not feasible and how it could be modified to make it feasible. The final objective is to develop integrative scenarios that attempt to combine positive features and exclude negative features from the various futures.

Step 3: Citizen integration

For Renn et al (1993), the third step draws together randomly selected citizens to evaluate policy options based on the performance profiles prepared by experts. Some of the specific formats that have been trialled include citizen advisory panels, citizen juries and lay-person's consensus conferences (Klinke & Renn 2002). Citizen involvement is required because: 'Citizens are the potential victims and benefactors [sic] of proposed planning measures; they are the best judges to evaluate the different options available on the basis of the concerns and impacts revealed through the other two groups' (Renn et al 1993, p.189). Stakeholders and experts participate in citizen decision-making by presenting their assessments to the citizen panel, either in person or using communications and information technology. This role is analogous to that of a witness in a trial; citizens can question the witnesses and seek clarification of particular issues. The citizens develop policy recommendations that are captured in a citizen report, prepared by the research team.

Carson and Gelber (2001) refer to this step as 'testing' but adopt a similar procedure in which randomly selected citizens meet and test the acceptability of policy options against the values and criteria established in Step 1. The most significant change proposed by Carson and Gelber is in the output from the testing step; the authors leave open the possibility that citizens may reject the policy options on offer as unacceptable. In this case, the process begins again from Step 1.

In my proposed model, this step is called citizen integration. The process is much the same as described above. A citizen forum is convened from randomly selected citizens to deliberate on the exploratory and normative scenarios that are the output of participatory IA. Preferably, the citizens participating in the forum would be the same citizens that developed the normative futures in Step 1. These citizens would then deliberate on the impacts of their desirable futures, providing them with an opportunity to change preferences. Stakeholders and experts would be available to act as witnesses and advisors to the deliberations, as required. The objective would be to select one or more desirable futures and identify the most robust policy strategy for achieving those futures. Ideally, citizens will be able to agree on a single desirable future and an associated action plan. However, where there is clear divergence within the group, the objective should be to identify an action plan that is consistent with multiple futures. For example, citizens might recommend further research on the desirable futures and an interim policy strategy that leaves pathways to each future open.

To aid the citizens in their task of integration, the facilitation role will be crucial. Facilitators will need to apply principles from integral theory to assist in the resolution of value and discourse conflicts. This might involve steering the discussion to quadrants or lines that have not been considered. It might also involve drawing out and expressing conflicts between discourses and suggesting resolutions that attempt to satisfy both discourses. However, it is ultimately up to the citizens to develop their own recommendations. If these recommendations are more consistent with, say, modern values than integral values, they should still be accepted as a valid expression of the average structure of consciousness within that group. Such a result will highlight the need for other policy approaches to facilitate subjective development; I suggest suitable approaches in Sections 8.5.3 and 8.5.4.

The deliberative process itself should be open to multiple forms of communication, as discussed in Section 8.4.2. Discussion and argument over scenarios is not the only possible approach. For example, Kasemir et al (2003a) describe a focus group process in which participants used collages to express their associations with different scenarios. Such approaches are entirely appropriate for an integral policy process.

Finally, I agree with Carson and Gelber (2001) that the citizens should have the option to recommend a return to earlier steps in the process if they feel that they are unable to make policy recommendations that are consistent with the values expressed in the initial normative futures work. This revisiting may occur within the citizen forum, as a reassessment of values by the participants or as a request for further modelling or assessment work by experts. Alternatively, it may be necessary to convene a new process with modified objectives. I would argue that flexibility to revisit unresolved issues should be a feature of the entire process, not only the citizen forum.

Step 4: Social learning

As discussed above, Carson (1999) added a fourth step to the cooperative discourse model focused on accountability and education. In Carson and Gelber (2001), this step is labelled 'evaluation'. The purpose of the fourth step is to communicate the results to the entire affected community and to evaluate the policy process itself. I have called this step social learning, as communication of results to the wider public provides an educational opportunity for the public, and evaluation of the policy process provides learning opportunities for process participants. This step is necessary for evolutionary policy development, discussed in more detail in Section 8.5.

8.4.4 Integral facilitation

In Section 8.4.3, I mentioned the important role of facilitation in the modified cooperative discourse model. In this section, I want briefly to consider the role of integral facilitation in a participatory policy process. Without integral facilitation, there is a risk that drawing out plural discourses through normative futures work and deliberation will lead to polarisation rather than integration.

One of the key roles of an integral facilitator is to identify policies that appeal to multiple discourses. In some cases, this may mean developing a policy package with components designed to appeal to different discourses. For example, regulatory approaches will appeal to hierarchical discourses, market approaches to rational discourses and group support approaches will appeal to postmodern discourses. In other cases, there may be specific policies that are robust across discourses. That is, some policies may be supported for different reasons by different discourses. Thompson (2000, p.105) gives the example of 'eating lower on the food chain', which egalitarians can support for ethical reasons and individualists can support 'in the pursuit of healthy living and personal success'.

In the case of climate change, one policy likely to achieve broad appeal is a legislated GHG reduction target. Egalitarians can support a target on ethical grounds, individualists because it provides investor certainty and an opportunity to make money by developing technologies or industries to meet the target and hierarchists because it is a regulatory expression of government leadership. In practice, there are likely to be numerous climate change response policies on which people from different discourses can agree.

The integral facilitator needs to hold plural perspectives in mind, but at the same time locate them within a developmental perspective. This requires the application of vision-logic. An integral facilitator 'encourages decisions, practices, and outlooks that are consistent with the most comprehensive and compassionate possible approaches in any given instance' (Zimmerman 2003, p.5). This means, say, assisting groups that have been framing a problem in rational terms to incorporate a postmodern or ecological perspective. The role of the integral facilitator is both to value all perspectives and to provide opportunities for subjective development towards more inclusive perspectives.

I believe that an integral facilitator needs to be more actively involved in the policy process than is typical of current facilitation roles. Their role is not just to keep discussion going according to an agenda. They should be willing to intervene, make judgements and arbitrate where necessary. In making these interventions, guiding principles are required, including sustainable development principles and the principles of integral methodological pluralism. Participants need to be made aware when a proposal would be detrimental to sustainability or would result in exclusion of valid perspectives or harm to people that are not recognised in a particular discourse.

The importance of the integral facilitation role and the demands it places on the individual indicate that proven facilitators with demonstrated skills and the ability to apply vision-logic should be preferred. These skills will be crucial in the transition to a sustainable future and should be valued by a society that is serious about sustainable development. I envisage the role as similar to that of a respected judge.

8.4.5 Locating the participatory model

The final issue I want to consider here is the relationship between the modified cooperative discourse model described in Section 8.4.3, the state and civil society. This relationship is important in determining the quality of participation and the fate of policy recommendations. Implementation within the state, or with state support, lends the participatory process credibility, which assists to attract suitable participants and increases the likelihood that policy recommendations will be acted on. Independent implementation, within civil society, would offer greater freedom to explore alternatives that may conflict with state imperatives. However, an independent process risks irrelevance if it is too far removed from the state.

Dryzek (2000, p.83) argues that inclusion of a movement or group in the state is appropriate when its defining concern is, or can be, aligned with a state imperative. The question is whether climate change response can, or should, become a state imperative. Given the ubiquity of fossil fuel consumption and unsustainable lifestyles in Australia, I would argue that substantial cuts in GHG emissions are only possible if climate change response becomes a core state imperative. The technological, economic and institutional changes required are too substantial and far-reaching to occur on the periphery. So far, as discussed in Section 5.2, climate change response in Australia has proceeded through no regrets policy initiatives that seek to align environmental objectives with core economic imperatives. However, climate change response in Australia has weakened due to a perception within the state that the costs of climate change response outweigh the benefits. The challenge, then, is to strengthen the case that climate change response is in Australia's economic interests or to make climate change response a state imperative on its own merits (e.g. for ethical reasons).

The role of those in civil society that are committed to climate change response is to continue to make economic and ethical arguments for climate change response in an attempt to influence interpretation of state imperatives. Dryzek (2000, p.87) argues that 'pressures for greater democracy almost always emanate from insurgency in oppositional civil society, rarely or never from the state itself'. Thus, if state imperatives are to develop, oppositional civil society must continue to publicly question those imperatives, creating a kind of cognitive dissonance between the state and civil society.

This discussion suggests that the modified cooperative discourse model should initially be applied in civil society. For example, it could be trialled as an academic research project or sponsored by a public interest group. However, the ultimate aim is adoption of the modified cooperative discourse model, or some other integral policy process, by the state. An interim stage would be adoption of an integral policy process by an independent inquiry able to make recommendations to the state but not ultimately responsible for decision-making. While it did not pursue an integral policy process, the Royal Commission on Environmental Pollution in the UK recently conducted an independent inquiry into energy and climate change policy that is similar to what would occur in this interim stage (UK RCEP 2000).

Australia has no analogous source of independent policy advice on environmental issues. The Productivity Commission, an Australian Government advisory body with commissioners appointed by the Governor-General, often deals with environmental issues. However, its primary responsibility is advice on microeconomic policy and regulation. A Sustainability Commission organised in a similar fashion, but with a mandate to consider the sustainability implications of policy, would be an ideal location to apply the modified cooperative discourse model. A Sustainability Commission would be consistent with the principle, proposed by Connor and Dovers (2004, p.206), that sustainable development can only take place if there is explicit institutional accommodation of a sustainability discourse (see Section 4.11.4). Their proposed National Council for Sustainable Development is another possible location for a participatory process of the type proposed here.

Wherever the process is applied, the fate of policy recommendations must be transparent from the outset. If the process is conducted in civil society, participants must be informed that policy recommendations will be used to advocate policy changes but there is no guarantee that policy will change. In processes closer to the state, it must be made clear whether policy recommendations will be binding on the state or considered as one input to a broader policy process. This type of transparency is crucial if trust is to be established between citizens and policy makers. Without such trust, ongoing participation by citizens in deliberative processes is unlikely. One way to make these issues clear at the outset of a participatory process is to establish a participation contract that outlines the roles and responsibilities of each of the parties involved.

8.5 The developmental task for climate change response

At the heart of integral theory is a developmental or evolutionary perspective. A commitment to integral theory implies adoption of an evolutionary approach to policy across the quadrants. In this section, I consider the nature of the developmental task associated with climate change response. In other words, I outline the predominant objective and subjective structures in Australia at present and identify structures that are consistent with an effective climate change response. I will address each of the quadrants in turn, while recognising that development is a process that occurs simultaneously in all quadrants and any separation is artificial.

8.5.1 Biological and behavioural development

A behavioural perspective draws attention to brain structure and human behaviour. As discussed in Section 3.3, human energy-using behaviour currently contributes to climate change and is not consistent with climate change response. In this regard, the behaviour of Australians, measured by per capita GHG emissions, is the worst in the world (Turton 2004). However, crucially, brain structure does not appear to be a significant barrier to climate change response, despite the sociobiological arguments discussed in Section 3.4. As Wilber (2001, p.33) puts it: ‘At this point in evolution, most individuals are biologically capable of integral consciousness’. That is, there is no biological factor preventing (most) Australians from adopting behaviours that are consistent with climate change response. Humans are quite capable of using efficient appliances, building renewable energy systems and designing socioeconomic systems to facilitate climate change response. The developmental task for climate change response does not include biological evolution. Behavioural change is required, but the source of this change is changes in systemic and subjective structures rather than biological structures.

8.5.2 Systemic development

The developmental task in the systemic quadrant is daunting. A civilisation built around the availability of cheap fossil fuels must develop new technological, economic, institutional and political systems consistent with low-carbon technologies. That is, a high-carbon civilisation must develop to a low-carbon civilisation – most likely a hydrogen civilisation. There are grounds for optimism. The Industrial Revolution demonstrates that radical changes in the systemic structure of civilisation are possible in relatively short periods of time. Of course, the Industrial Revolution was an extraordinarily painful process for the vast proportion of people involved, so there is a need for caution in such comparisons. However, there is a significant difference between the Industrial Revolution and the revolution required to respond to climate change – the climate response revolution will be driven by a conscious objective of atmospheric stabilisation. This is historically unprecedented and provides an opportunity to reduce the negative impacts of systemic changes by anticipating them.

According to Wilber (2003d, p.99), developments in social institutions and the techno-economic base tend to run ahead of developments in the other quadrants, creating pressure for subjective development to catch up. He argues that technological innovation only requires a change in the material structure of production, which can occur very rapidly, whereas subjective development is 'a notoriously slow and difficult process' (Wilber 2003a, Part III, p.1). Wilber often identifies the recent development of a global network of communication and information technologies, including the Internet, with the emergence of a new information age that constitutes a qualitatively new systemic structure (e.g. Wilber 2001, p.34). The implication is that the new techno-economic base is already providing pressure for subjective development. Wilber is not arguing that subjective development is guaranteed – far from it. However, he does argue that the technologies to support worldcentric awareness are in place (Wilber 2001, p.34).

The situation with respect to climate change response is, I think, more complicated. The much vaunted information technologies have not penetrated the energy system to any great extent. Australia's energy system still relies predominantly on industrial era technologies that burn fossil fuels. In fact, the information technologies themselves are little more than a veneer on top of the industrial system. Follow the wires from the back of most computers in Australia and you will eventually find yourself at a large power station and coalmine employing industrial-era technology. For the energy system, the information revolution is only just beginning.

The slow pace of technological change in the energy system compared to, say, the computing industry, is linked to the problem of carbon lock-in discussed in Chapter 3. The industrial energy system has developed such inertia, such economies of scale and such a weight of institutional baggage that rapid change is strongly resisted. Of course, there are also subjective issues contributing to lock-in, including the dominance of the Ego camp and its narrow economic growth ideology. Clearly, one of the developmental tasks for climate change response is to overcome lock-in in the systemic quadrant. I suggested some systemic policies for overcoming lock-in in Section 8.3.2, including direct support for alternative technologies and strategic niche management. I also believe that the normative approaches discussed in Section 8.4.1 can contribute to the move away from lock-in, as they encourage thinking focused on trend breaking and creation of desirable futures.

While technological change may not be providing a strong impetus for subjective development in relation to climate change, there are social practices or paradigms that are providing such an impetus. The data from global atmospheric and ecological measurements and global models, collated by the IPCC, are the product of a new global scientific paradigm focused on global system relationships. Climate change is a problem that has only become evident in the last few decades with the advent of satellite measurement techniques, powerful computer modelling capabilities and the development of information networks linking scientists around the world. Thus, from this perspective, it is true to say that changes in social practices are acting as a driver for subjective development. The data emerging from these new social practices can only be fully understood by people adopting worldcentric awareness and applying vision-logic.

In the sections below, I will consider particular aspects of systemic development in more detail. First, I will consider what the emerging communication and information technologies imply for energy technologies. Second, given the dominance of economic analysis in Australian energy and greenhouse policy decisions, I will discuss evolutionary economics as an approach that is consistent with developmental theory. Third, I will examine emerging evolutionary approaches to policy and their implications for policy content. Fourth, I will discuss the design of institutions to facilitate social learning. Finally, I will discuss the role of the international climate policy framework.

The new technological paradigm

It is worth briefly considering the characteristics of the emerging information and communication technologies usually associated with the information age, to identify possible implications for new energy technologies. First, the new information technologies are distributed or dispersed and small-scale. If energy technologies follow the same pattern, distributed generation will be an important part of the emerging energy system. There will be a move away from centralised generation towards local generation technologies, including photovoltaic power, fuel cells and cogeneration facilities. Second, the new information technologies are networked. For the energy system, it is reasonable to expect that more sophisticated networking and control technologies will emerge, allowing generation to more closely follow load throughout the system. These control technologies will be integrated with the Internet (or its successor) and will extend into homes, allowing appliances to be switched on or off at particular times and drawing on load from distributed generation sources as required.

Similar predictions are evident in the literature. For example, Elliott (2000) describes the conventional and alternative energy paradigms. The conventional energy paradigm relies on finite stocks of concentrated fuel, large-scale technologies, centralised power generation and a monopoly energy market. This paradigm creates large, global environmental impacts, including climate change. The new energy paradigm relies on renewable flows of fuel, diffuse energy types, smaller scale technologies, decentralised generation and a liberalised market. This normative paradigm creates small, local environmental impacts that are more readily managed than the impacts associated with climate change. Another example is Inglehart's (2000) identification of an emerging 'postmaterial' culture that emphasises networking and communication rather than possessions. I believe that it would be wise for policy makers to consider the characteristics of information and communication technologies when considering allocation of funding support for energy technologies.

Evolutionary economics

In Section 3.7.2, I discussed some of the limitations of neoclassical economic analysis when applied to climate change response. Despite these limitations, I found in Chapter 5 that neoclassical economic analysis methods remain the primary tool used by policy makers to assess energy and greenhouse policies in Australia. In Section 8.3.2, I argued that economic analysis should be balanced with other analysis tools within an integrated assessment framework. However, this is a long-term normative ideal. The reality in the short-term is that economic analysis will be difficult to dislodge from its central role in decision-making. Consequently, promotion of forms of economic analysis that are consistent with evolutionary theory is a short-term priority.

Fortunately, there is a long history of evolutionary theorising in economics (Nelson & Winter 2002). According to Nelson and Winter (2002), modern economic analysis, from Adam Smith onwards, has focused on three guiding questions. The first two, concerned with coordination of economic activity and the relationships between prices, inputs and outputs, pull economic theorising towards an equilibrium orientation. The third, concerned with economic progress and development, pulls theorising towards an evolutionary orientation. Nelson and Winter (2002, p.24) argue that evolutionary theorising in economics was strong in the early 20th century, but was overwhelmed by the 'increasing fixation of neoclassical economic theory on equilibrium conditions'. Thus, the 'neoclassical understanding of evolution [became] synonymous with a determined process whereby progress is taken for granted, and a unique, optimal equilibrium is expected as the final result' (Rammel & van den Bergh 2003, p.125).

In recent years, evolutionary approaches in economics have begun to grow in popularity again, partly due to growing awareness that standard neoclassical economic theory deals poorly with disequilibrium dynamics and 'processes of economic growth driven by technological change' (Nelson & Winter 2002, p.24). Where neoclassical economic theory compares different equilibria, usually within a static framework, evolutionary economic theory is explicitly concerned with economic change (Mulder & van den Bergh 2001). The evolutionary approach 'focuses attention on irreversible, path-dependent change and long-run mutual selection of environmental and economic processes and systems' (Mulder & van den Bergh 2001, p.110). Kauffman (2000, p.229) captures the evolutionary orientation eloquently when he entreats economists to:

> Consider the economy as forever becoming, burgeoning with new ways of making a living, new ways of creating value and advantages of trade, while old ways go extinct. This too is the proper subject for your study, not just allocation of scarce resources and achievement of market-clearing prices. The economy, like the biosphere, is about persistent creativity in ways of making a living.

An evolutionary orientation is particularly important for sustainable development policy and climate change response, both of which seek to create a situation of disequilibrium that brings about a long-term adaptive shift from an unsustainable society to a sustainable society. According to Rammel and van den Bergh (2003, p.125), 'evolutionary economics has the potential to integrate notions of non-optimised change, uncertainty and long-term development into sustainable development policies'. In other words, an evolutionary approach to economic analysis acknowledges that climate change response policies will always be sub-optimal and therefore focuses on ongoing adaptation and learning through policy innovation and experimentation.

To date, applications of evolutionary economics to climate change response have been largely theoretical, highlighting issues such as path dependence, lock-in and, particularly, diversity in technological and institutional responses to climate change. Conventional cost-benefit approaches and policies seek efficiency rather than diversity; their long-term impact is to lower technological and institutional diversity, resulting in the observed situation of fossil fuel lock-in (Rammel & van den Bergh 2003). This again highlights the need to employ economic analysis within a broader framework that is more responsive to uncertainty and the needs of natural systems.

Despite the theoretical contributions of evolutionary economic theory, there have been relatively few practical modelling applications suitable to employ as an alternative or complement to traditional economic analysis of policy. However, some modelling applications are emerging. For example, Janssen and de Vries (1998) use a multi-agent modelling approach to illustrate the use of evolutionary modelling in the context of integrated assessment of climate change. Agents in the model are able to adapt their perspective based on observations about the real world. Evolutionary economic modelling approaches of this type deserve more attention within the context of integrated assessment of climate change in Australia.

For businesses adopting a developmental perspective, it is evident that climate change response will be a growth business over the 21st century and that those businesses that are positioned to take advantage of this situation will reap rewards. Businesses that can provide low-carbon technologies at a competitive cost will have a significant advantage over businesses that remain focused on fossil fuel technologies. This means investing in renewable energy technologies that are currently expensive (e.g. photovoltaic power) in recognition that there will be a huge market for these technologies once costs fall and climate change response becomes a norm. Further, the growing numbers of ecologically aware consumers are a potential market that will readily adopt products with lower environmental impact, as long as they cost about the same as existing products, and provide the same level of service. The current race between motor vehicle manufacturers to bring hybrid and fuel cell vehicles to the market is evidence that businesses recognise this fact. A motor vehicle that performs as well as a conventional vehicle, at a similar cost, but with far lower GHG emissions, will have an important market advantage.

Evolutionary policy approaches

A developmental perspective in the systemic quadrant provides support for an evolutionary approach to policy, founded on the theory and practice of adaptive management (e.g. Holling 1978; Kay et al 1999). Adaptive management was initially developed as a natural resource management technique in the 1970s (Holling 1978). It draws on theories of biological evolution to guide ecosystem management policies. According to Kay et al (1999, p.737):

> In adaptive management, differences between how the future actually unfolds and how it was anticipated that the future would unfold, are seen as opportunities for learning. This is in sharp contrast to anticipatory management which sees such deviations as errors to be avoided. Much of the agenda of adaptive management is learning through experimentation rather than focusing on error avoidance.

In other words, adaptive management is a process of systematically trialling assumptions and methods, learning from the results and using that learning to design better management systems. It is an explicitly developmental process.

Although adaptive management was initially applied to natural resources, it quickly became apparent that techniques applied to natural systems could equally be applied to social systems. Several authors have explored the implications of evolutionary thinking for environmental policy and sustainable development (e.g. Rammel & van den Bergh 2003; Ring 1997; Robèrt et al 2002). Evolutionary policies take inspiration from evolutionary or developmental theories in their design and implementation. Evolutionary approaches to policy recognise that policy development is a dynamic process, that it is impossible to design optimal policies when faced with future uncertainty and changing values and that it is therefore necessary to adopt diverse and flexible policies that can adapt to changing circumstances and new knowledge (Rammel & van den Bergh 2003; Ring 1997). An evolutionary approach gives preference to policies that are robust across a broad range of possible futures.

Below, I will outline some recurring recommendations for the content of evolutionary policies that are consistent with integral theory.

Build on successes

Evolutionary policies seek to build on previous successes. Initially, this means reviewing policies that have been implemented elsewhere; those that were successful might provide a good starting point for local implementation. Of course, variable contexts always mean that a policy that works in one place might not work in another. The purpose of an evolutionary policy approach is to learn from any failures and design a better policy for the local context. In integral theory, the understanding of development as a process of transcendence and inclusion provides support for starting with previous successes as the basis for developing new policies, but creatively adapting to local context.

Adaptive flexibility

Given that the future behaviour of complex systems is uncertain, flexibility is an important principle for evolutionary policies. Policy flexibility is necessary to allow adaptation to unanticipated conditions. In a sustainable development context, policy flexibility also means avoiding policies that improve short-term sustainability but create long-term dead ends (Robèrt et al 2002, p.201). Further, flexibility is a characteristic of robust policies that will deliver the most desirable set of outcomes across multiple possible futures. Robust policies are not reliant on fragile assumptions for their success. They leave options open and avoid high-risk pathways. Robèrt et al (2002, p.201) give the example of a car engine that is not only fuel efficient but also has the future potential to run on other fuels.

To further illustrate this principle, consider the role of natural gas in reducing GHG emissions from the energy system. As noted in Section 3.5.2, natural gas generates fewer GHG emissions per unit of energy service than coal and oil. Substitution of natural gas for coal and oil in power stations, vehicles and other applications is an effective policy strategy for short-term GHG emission reduction. However, combustion of natural gas still generates significant GHG emissions. An evolutionary policy approach would seek to design new natural gas infrastructure with sufficient flexibility to easily move to other technologies when deeper GHG emission cuts are required. One possibility is to design pipeline infrastructure so that it can be easily and cheaply refitted to transport hydrogen in the future. In this way, the new infrastructure increases energy system options, rather than constraining them.

Diversity

In adaptive management, biodiversity is seen as an indicator of the resilience of an ecosystem – its 'ability to maintain structure and self-organisation…in the face of external stress' (Rammel & van den Bergh 2003, p.124). For evolutionary policies, the analogy is that technological, institutional, socioeconomic and cultural diversity provides a source of flexibility and resilience for responding to uncertainty (Matutinovic 2001). In this case, it is the resilience and sustainability of human systems, in response to stresses like climate change, that is at issue. Diversity provides evolutionary potential – 'a repertoire of alternative options [that] increases the possibility that altered conditions can be successfully met through pre-adaptations and further evolution' (Rammel & van den Bergh 2003, p.127).

I raised the issue of diversity in Section 8.3.2, in my discussion of portfolio approaches in technology policy. If a diverse range of technological and institutional responses is available, responses that fail under unexpected conditions can be discarded in favour of those that are successful under those conditions. An energy system that relies almost entirely on fossil fuels, like the current system in Australia, is inflexible. It is vulnerable to any disruption of cheap fossil fuel supply and possesses significant inertia when unexpected problems (e.g. climate change) arise. A prudent technological response to the provision of energy services is to rely on a diverse portfolio of energy technologies, so that disruptions to one can be balanced by increased utilisation of another.

Precaution

Evolutionary policies are precautionary, or risk minimising (Rammel & van den Bergh 2003), as a way of responding to uncertainty in the behaviour of complex natural and social systems. Risk minimising 'is based on the awareness that evolving systems are complex and can neither be understood nor controlled completely. Therefore, decentralised policies are attractive, notably ones based on self-organisation or self-regulation and co-evolutionary mechanisms' (Rammel & van den Bergh 2003, p.130). I have already discussed the precautionary principle as an appropriate guide for policy in response to uncertainty (see Section 8.3.2).

Institutional design and social learning

One of the most important implications of a developmental perspective on climate change response (and sustainable development) in the systemic quadrant is the need to design policy-related institutions to facilitate social learning. Robinson (2004, pp.378-379) notes that: 'There is an inevitably experimental, and experiential, nature to sustainability'. In other words, when designing sustainable development policies and institutions to deliver them, it is impossible to achieve optimal outcomes. The approach to policy must therefore be experimental and open to the social learning potential of unanticipated outcomes. Consequently, there must be feedback mechanisms in place to measure the outcomes of policy experiments and a flexible institutional culture that is open to continual adaptive change. In the sections below, I will discuss some of the elements that need to be considered in institutional design to embed an evolutionary perspective.

A clear policy target

The design of institutions to deliver evolutionary policies must start with the establishment of a clear policy target. Biological evolution operates in response to the immediate environment, without a long-term objective. While the results may be adaptive, extinction is also a real possibility. The advantage of evolution in the noosphere is that humans are capable of directing the process towards normative ends. Climate change response and sustainable development clearly require such direction to achieve desirable outcomes. The establishment of a clear policy target is an appropriate way to provide direction for institutions, while also providing a benchmark against which to evaluate the success of policy experiments.

In Section 3.8.3, I reviewed principles of institutional change proposed by Connor and Dovers (2004). One of these principles emphasised the need for legal change as a way of codifying institutions. In the case of climate change response, I believe that legal change is required to establish a long-term policy target for Australia. Specifically, I believe that the Australian Government should introduce a Climate Change Response Act (or equivalent) that establishes a long-term GHG reduction target for Australia, such as a 60 per cent reduction in emissions by 2050.[72] The Act would also implement various enabling mechanisms for achieving the target, such as emissions trading and a portfolio approach to technological research, development and commercialisation. Legislating a GHG reduction target would provide a greater degree of certainty for those considering investment in low-carbon technologies and would act as a driver to orient other institutions towards climate change response. Regulatory certainty was identified as an important issue in energy and greenhouse policy during a recent review of energy market policy in Australia (COAG 2002, p.229).

The principle of subsidiarity

The principle of subsidiarity, discussed in Section 3.8.3, is also important for the design of evolutionary institutions. Indeed, one of Wilber's twenty tenets (see Appendix A) is that evolution increases the relative autonomy of holons, which means that subsidiarity should increase as evolution proceeds. Subsidiarity implies decentralisation of elements of policymaking and implementation. While an appropriate role of the Australian Government is to establish national GHG reduction targets and policy schemes, much of the detail of policy implementation will occur at State and local levels. State and local authorities should have as much freedom as possible to pursue creative solutions to climate change response, recognising that not all of the policy experiments or forms of institutional delivery will be entirely successful. That is, higher levels of government should not specify the ways in which targets are to be achieved. Subsidiarity is one way of providing the policy diversity from which successful responses can be selected.

A recent review of energy market policy in Australia found that measures being pursued by the various States were poorly targeted (i.e. target particular fuels, technologies or processes rather than GHG emissions), lacked coordination, competed with each other and created uncertainty (COAG 2002, pp.229-232). The review recommended replacing these diverse measures with a single, national emissions trading scheme. While better coordination is certainly needed, it should not be pursued at the expense of the diversity represented in existing attempts to grapple with climate change response. A national emissions trading scheme is appropriate, but needs to be complemented by targeted funding for diverse technology and policy measures that are not currently the most economically efficient ways of reducing GHG emissions.

[72] In the short-term, ratification of the Kyoto Protocol would be an appropriate way to legally establish a clear policy target.

Feedback and evaluation

Feedback is an essential component of any evolutionary policy approach. The impacts of each policy experiment must feed back into the policy process so that the policy can be modified if objectives have not been met. Feedback can occur through evaluations of particular policies or programs, including independent inquiries and reviews of the type routinely used in Australian energy and greenhouse policy. In some cases, feedback can also be built into policy design. For example, the NSW Building Sustainability Index (BASIX) – a planning assessment tool introduced in July 2004 – requires new homes to use 40 per cent less water and generate 25 per cent less GHG emissions than average NSW homes of the same type. When applying to build a new home, applicants must complete an online assessment that compares the water and energy efficiency of their home to an average benchmark dwelling. The feedback component is that the assessment tool maintains a database of each application so that the impact of the policy on new home designs can be evaluated.

Reflexivity

Institutions designed to deliver evolutionary policies need to be reflexive. That is, they need to be able to take feedback and evaluation results, reflect on the implications and apply lessons to the design of new policies and institutions. A cyclical approach to policy implementation, comprising 'cycles of action, reflection, futures questioning and then action again' supports institutional reflexivity (Inayatullah 2002b, p.298). This is as much an attitudinal requirement as a process requirement. Adams and Thompson (2002), drawing on grid-group cultural theory, use the concept of **clumsy institutions** to capture the orientation required. Clumsy institutions are aware of their limits, recognise that they do not possess all the answers and listen to multiple voices offering criticisms and possible solutions. Reflexive institutions must be willing to question norms, assumptions and practices (Michaelis 2003, p.S140) and periodically reassess and reiterate objectives as conditions change (Connor & Dovers 2004, pp.221-222).

Documentation and dissemination

Finally, for social learning to occur beyond the confines of a particular organisation or institution, the results of feedback, evaluation and reflection need to be documented and disseminated. It is inevitable that people pursuing climate change response will face similar problems, despite contextual variations. Thus, the lessons learnt in one context may well have relevance in another. As the body of policy experiments grows, there is a need to identify successes and failures across national and international contexts and begin to draw out the most successful strategies. Climate change response requires a global process of social learning.

Norgaard (2004, p.239) argues that: 'Bringing collective knowledge together requires some sort of social organization and rules of interaction. Scientific understanding of complex problems is necessarily a collective social process that will depend on organizational structures and rules'. The IPCC, given that it has already displayed a capacity for institutional learning (Norgaard 2004; Siebenhüner 2002), remains an appropriate organisational structure for documentation and dissemination of the results of international climate policy experimentation. In Australia, a Sustainability Commission or National Council for Sustainable Development could take on this role.

The international climate policy framework

The international climate policy framework will be crucial in determining the effectiveness of the global response to climate change and, despite Australia's current refusal to ratify the Kyoto Protocol, will undoubtedly have a strong influence on future climate policy in Australia. As the global framework for climate change response, the Kyoto Protocol and subsequent agreements have the difficult task of offering reasons to participate in climate change response to all nations, whatever their average structure of consciousness. Thus, the policy framework must provide threats and inducements to appeal to egocentric values, hierarchy and order to appeal to mythic values, economic opportunities to appeal to modern values and ecological and ethical outcomes to appeal to postmodern values. Some of these appeals may occur outside the climate policy framework, for example through trade negotiations or provision of economic aid.

The Kyoto Protocol does not attempt full inclusion of all developing countries, which is justifiable on ethical grounds, but represents a compromise on ecological outcomes. Based on the objections raised by Australia and the United States, it does not seem to provide sufficient economic opportunities either. However, none of the commonly proposed alternatives seem to meet all of the requirements outlined above (Aldy, Barrett & Stavins 2003). While a single common framework has administrative advantages, I believe that a future climate policy framework will need to offer different kinds of commitment for different nation-states. That is, diverse frameworks will coexist, designed to appeal to different groups.

Philibert and Pershing (2001) provide an example in which dynamic targets (relative to economic growth), fixed (binding) targets, non-binding targets, sectoral targets and defined policies and measures all coexist. This would mean the continuation of a differentiated regime of the type embedded in the Kyoto Protocol, with the introduction of greater flexibility and diversity to attract broader participation. Within this type of regime, the US greenhouse intensity target would be acceptable, facilitating US participation in the framework. Encouraging diversity within the framework would have the added advantage of providing multiple policy experiments out of which a future common framework might develop. If worldcentric awareness continues to grow globally, the contraction and convergence approach would appear to be the logical choice for a common framework, as it is based on worldcentric ethics.

8.5.3 Psychological development

In Section 2.3.5, I described processes of psychological development and the subjective structures that emerge as development progresses. I outlined the way in which each successive developmental structure transcends and includes the previous structure, so that later structures are more inclusive. For example, moral development is characterised by gradual expansion of the individual's circle of care, from the self (archaic, magic and egocentric values), to an ethnic or social group that shares the individual's values (mythic values), to all people that adopt rational values (modern values), to all people without exception (postmodern and integral values). Later developmental waves, therefore, are more tolerant of other perspectives and more likely to work towards social harmony. This is an important reason to advocate policies that facilitate subjective development.

Developmental processes also increase complexity by building new structures, corresponding to new abilities and understandings, on previous structures. For example, cognitive development increases the individual's capacity to recognise and understand the complex system interactions that characterise environmental and social problems. It is for these reasons that subjective development is crucial to an integral climate change response and to sustainable development more generally. As Wilber (2000c, p.541) puts it:

> The problem is *not* how to demonstrate, in monological terms and with scientific proofs, that Gaia is in desperate trouble. The general evidence of this serious trouble is already and simply and absolutely overwhelming. Anybody can grasp the data. But most just don't *care*. In other words, the real problem is *not* exterior. The real problem is *interior*. The real problem is how to get people to *internally transform* from egocentric to sociocentric to worldcentric consciousness, which is the *only* stance that *can* grasp the global dimensions of the problem in the first place, and thus the *only* stance that can freely, even eagerly, embrace global solutions.[73]

How, then, do processes of psychological development proceed? I touched on this issue in Section 2.3.5 but will provide more detail here. Assuming that conditions in the behavioural, systemic and cultural quadrants are conducive to psychological development, Wilber (2001, p.35) argues that there are four important factors in moving from one developmental wave to the next. The first is **fulfilment**. The individual must have spent sufficient time at that wave to experience what it has to offer and be ready to move on. For example, if the wave is modern values, this might mean adopting a consumer lifestyle and experiencing the pleasures of material consumption. Second, the individual must experience frustration with some aspect of the existing wave, which manifests as **dissonance** or disequilibration. Continuing the example of modern values, this might mean that material consumption no longer provides satisfaction and feels wrong in some way that is difficult to express. Third, the individual must experience an **insight** that allows him or her to let go of, or differentiate from, the old wave. For modern values, insight might be provided by a public lecture

[73] Italics in original.

on the ecological impacts of material consumption. Finally, if the first three factors are in place, the individual experiences an **opening** to the new wave, which in this example would be post-material or ecological values.

According to the developmental theorist Robert Kegan, it takes an average of five years for most people to move through any major stage of development (Wilber 2003d, p.35). Thus, psychological development is not something that can easily be initiated by short-term policy initiatives. Nevertheless, in the sections below, I will outline policies that have some potential to prompt psychological development in the context of climate change response, mainly by providing sources of dissonance or insight.

Constructivist learning

Education has always been considered an important policy strategy for encouraging individuals to respond to environmental problems, including climate change. Education remains important in an integral policy response to climate change. However, educational strategies need to be guided by constructivist models of learning that draw on the insights of cognitive psychology and structural developmental theory. A constructivist approach to education emphasises construction over instruction, interest over reinforcement, autonomy over obedience and cooperation over coercion (Kahn 1999, p.213). It recognises that construction of knowledge occurs through transformations brought about by active and original engagement with the world. Constructivist models of learning emphasise the role of the subject in actively constructing meaning through interaction and experience, mediated by social and cultural context. Constructivists 'believe that knowledge is dynamic rather than static, a process rather than a thing, a pattern of action rather than an object' (Gagnon & Collay 2001, p.xvi). That is, constructivists argue that learning is a developmental process that creatively builds on existing structures. This is consistent with integral theory. In particular, constructivist learning has the potential to create dissonance and provide insight.

According to Kahn (1999, p.213), teachers can facilitate constructivist learning by cultivating student interests and building a curriculum that supports these interests. Constructivist teachers foster student autonomy and independent thinking by, for example, providing coherent reasons for their actions. In addition, constructivist teachers seek to develop cooperative approaches between students. Policies to encourage constructivist learning focus on providing people with opportunities for interaction, play and experimentation. These types of policies fit well with the participatory model outlined in Section 8.4. In Section 8.4.1, I discussed the application of computer simulation models in the Georgia Basin Futures Project (see Robinson 2003). These models allowed participants to experiment with different futures and learn about the consequences of those futures. This is a good example of a constructivist approach to learning.

In another example, reported by Weeks (2000), citizens in the town of Eugene, Oregon were engaged in a deliberative exercise focused on solving the town's budget problems. As part of this exercise, participants were given a budget worksheet and encouraged to experiment with additions and reductions to municipal services to arrive at a balanced budget. By experimenting with the same problem faced by the municipal government, participants were able to learn about the issues faced by government decision makers and develop a deeper appreciation of the tradeoffs required to provide new services.

A commitment to constructivist learning should be fundamental to the design of both educational strategies and participatory strategies within an integral policy process. This commitment may be as simple as tailoring information and advice to the context of the individual seeking or receiving that advice. In other cases, it may involve the design of complex computer simulations and interfaces to engage individuals in learning in relation to climate change. More broadly, it requires a societal shift towards education that teaches people how to learn throughout their lives.

Civic participation

There is evidence that participants in multi-stakeholder collaborative processes and deliberative forums can experience transformation of preferences (Dryzek 2000), develop greater tolerance for differences of opinion (Halvorsen 2003), undergo personal transformation and learning (O'Neill 2002), experience changes in subjective understandings and relationships (Poncelet 2001) and develop ecological values (Gundersen 1995). In other words, there is evidence that public participation, particularly in forums designed to promote deliberation, can prompt psychological development. Thus, participation of the sort contemplated in Section 8.4 may not only be a way of accessing the subjective quadrants but also of facilitating subjective development.

How might civic participation prompt psychological development? For many people, participation in a project of this sort is an empowering experience that has repercussions in other aspects of their lives. It can help people to reconnect with the political process and feel that their views are important. However, empowerment does not equate to psychological development. I would argue that participation has the potential both to create dissonance and to provide insight. Participation and dialogue expose an individual to different evidence, ideas, values, perspectives and opinions, some of which they may not have previously encountered. In some cases, the individual may need to resolve conflicts between these new elements and existing developmental structures. These conflicts may create a new source of dissonance or may provide insight into an existing dissonance. I would conclude that participatory processes do offer potential for psychological development but that much depends on the previous experience of the individual and the social and cultural context.

I believe that further theoretical and empirical investigation is required to identify participatory situations that are more likely to prompt psychological development. Warren (1992), for example, argues that personal transformation should only be expected in particular deliberative contexts, when deliberating on issues that are non-conflictual or particular types of public goods that only achieve their value through social interaction and deliberation. In addition, participation may result in learning and new knowledge without prompting dissonance or insight. Results may also depend on the specific characteristics of the participatory model. In the next section, I will consider a participatory approach that I believe is particularly worthy of empirical testing.

Deliberation across difference

In Australia's immediate region, many Pacific island nations are threatened by rising sea levels and may face evacuation if climate change continues. Some islands are already affected by saline intrusion and vulnerability to storms is increasing. Tuvalu and Kiribati expect to evacuate their entire populations over the next 50 years (Vick 2001). For people operating from a worldcentric perspective, the plight of those in developing nations that are already affected by climate change is deeply disturbing. For people operating from a sociocentric perspective, exposure to the human impacts of climate change in Australia's immediate region is a possible source of dissonance that can prompt moral and ethical development.

One way to expose Australians to these impacts is to hold a well-publicised international deliberative forum, with citizen representatives from Australia and nearby developing nations affected by climate change, to deliberate on an ethical response to climate change. The forum would consider issues of rights and responsibility in relation to climate change and propose regional climate change responses. A deliberative forum operating across national and cultural differences could be a powerful developmental experience for the participants, due to the degree of exposure to different ways of thinking and perspectives. Further, it would have strong symbolic value as an attempt at ethical engagement across cultures, potentially prompting broader cultural development. The modified cooperative discourse model could be used as a framework for the deliberations.

Integral transformative practice

Perhaps the most powerful tool for psychological development, but one that is difficult to develop as a specific policy strategy, is integral transformative practice. Integral transformative practice refers to a range of practices across quadrants, waves and streams, that an individual can adopt to promote psychological development. These practices might include physical exercise, therapy or counselling, mental exercises, meditation and reflection, community service, civic participation, attention to relationships, recycling and nature celebration, to give a few examples (Wilber 2001, p.138). What all these practices have in common, I believe, is that they deepen and broaden individual experience of reality, providing greater opportunity for dissonance and insight to arise across multiple developmental streams. It is largely up to the individual to adopt these practices, although there are policies that can make the adoption easier, such as introducing these practices into schools.

8.5.4 Community cultural development

Individual psychological development is not sufficient to support an integral climate change response if there is not a corresponding cultural development that allows individuals to express their new subjective insights in collective settings. Wilber (2001, p.33) argues that, due to the effect of three decades in which a significant percentage of the American and European populations have operated from ecological and postmodern values, there is a 'cultural readiness' for integral consciousness to emerge. As the systemic quadrant is 'perhaps, the single strongest determinant of *the average level* of consciousness in any given society' (Wilber 2002, Sidebar A, Part III)[74], and the techno-economic base in Australia is very similar to that in North America and Europe, it is reasonable to assume that the same cultural readiness exists in Australia.

However, in the context of climate change response, it is a modern, rational discourse that remains dominant rather than a postmodern, ecological discourse. The modern discourse is fundamentally committed to economic growth and exploitation of primary resources. This commitment has taken on all the characteristics of ideology, including 'hidden interests, hidden power claims, parading as truth, a truth that cannot be *exposed to evidence* without robbing it of its *power*' (Wilber 2000c, p.457).[75] Postmodern discourse is perfectly placed to draw the deeply buried assumptions of modern discourse into the light, exposing them as cultural myths and perhaps initiating dissonance for those committed to modern discourse. Consequently, the immediate priority for an integral climate change response in Australia is to find ways to introduce a postmodern and ecological discourse into decision-making. This is a precursor to any further development towards an integral culture, at least in the context of climate change response.

The participatory model discussed in Section 8.4 provides one method to introduce broader discursive knowledge into the policy process. However, the proposed model only engages a small number of citizens directly. A citizen forum with integral facilitation would only be manageable with a group of, say, less than twenty citizens. A major policy process may bring together groups from across Australia; however, total direct citizen participation is likely to be in the hundreds rather than thousands. Further, although citizens are randomly allocated the opportunity to participate, not all citizens are willing to take up this opportunity. According to Renn (1999), acceptance rates range from 5 to 40 per cent (depending on the issue), even when employers are paid to let people attend and child care and other services are provided. Thus, the proposed participatory model will only ever engage a tiny proportion of the community directly, and will never reach some citizens that are unwilling to participate. It engages only sufficient subjectivity to meet the needs of decision makers within the state.

[74] Italics in original.
[75] Italics in original.

From an integral perspective, broader cultural engagement is necessary for several reasons. First, the proposed participatory model may routinely exclude people operating from particular subjective structures that do not find the idea of group deliberation attractive. These people may always refuse the opportunity of participation when offered. For example, people operating from egocentric values may see no real gain for them in participation while finding the idea of deliberating for several days tedious. If people operating from egocentric values always refuse the opportunity to participate, or refuse more often, then an important discourse will be excluded from decision-making. Alternative methods are needed to improve the likelihood of engaging all relevant discourses in the policy process.

Second, as discussed in Section 8.4.5, the proposed participatory model has little chance of becoming established unless there is cultural pressure from civil society to make climate change response and citizen inclusion core state imperatives. This pressure is more likely to come about if more people in civil society identify with a postmodern or ecological discourse, which can only occur through processes of subjective development (Wilber 2000c, p.541). Shared engagement with a global issue like climate change, which embodies global system relationships and has definite ethical dimensions, has the potential to contribute to processes of cultural development.

Finally, in Section 4.5, I discussed the intangibility of energy use and climate change as a barrier to climate change response. Climate change response is more likely to become a priority in civil society if ways can be found to make climate change seem tangible and relevant. This implies strengthening the cultural response of individuals and communities to climate change.

I propose **community cultural development** as a method for engaging civil society in climate change response and promoting subjective development. Community cultural development is 'a collective process, often involving creativity interpreted in the broadest sense…[that] contributes to changes in people's lives and long-term developmental benefits for a community' (Mills & Brown 2004, p.6). It involves the creation of art in, for, with or by a community (Pitts & Watt 2001), often through a partnership between artists and communities. A community can be any group of people that identify with each other (Australia Council 2004). Community cultural development attempts to make artistic expression an integral part of daily life, rather than an elitist institution reserved for professional artists.

In practice:

> …community cultural development involves a wide range of art forms, from performance to visual arts, from film and video to writing, oral history and storytelling. Its creative outcomes may be everything from public art to festivals, theatre and dance performances, exhibitions, publications and seminars. All of these activities, and there are many others that could be mentioned, have in common the collaborative and empowering processes by which participants engage with creative activity (Mills & Brown 2004, p.6).

Thus, community cultural development is an approach that seems perfectly tailored to encourage subjective engagement with particular issues, such as climate change. I am therefore proposing that community cultural development is included in any integral policy process on climate change and is part of any integral climate change response. In the sections below, I will consider specific ways in which community cultural development engages subjectivity in the context of climate change response.

Art and climate change

Art, and reactions to it, are inherently subjective. When citizens respond to, or participate in, creative processes they reveal values and perspectives that may not be as readily accessed through processes of discussion and deliberation. For the individual, the creative act can express their subjective interior – the psychological quadrant. Further, the emphasis in community cultural development on community and culture encourages access to the subjective interiors of groups – the cultural quadrant. In addition, the creative act encourages direct engagement with the non-rational imagination, allowing values other than rational modern values to emerge. Thus, community cultural development engages the subjective quadrants.

There are numerous ways in which art can engage subjectivity in the context of climate change response. Some examples include:

- A professional art exhibition with climate change as the theme, helping citizens to emotionally engage with the idea of climate change and combating to some extent the intangible nature of climate change
- A public art project in which citizens are provided with materials and encouraged to create art expressing their response to the threat of climate change in a public space
- Small-group exercises, perhaps in the context of a participatory policy process, in which participants are provided with materials and encouraged to create artworks expressing their response to climate change (an example, described by Kasemir et al. (2003), is the creation of collages by participants in IA focus groups in response to different energy futures)
- The use of stories, narrative and creative writing exercises to draw out relationships between people, energy use and climate change (for an example of such an approach, applied to water consumption, see Bolitho (2003))
- A design competition to identify ways of making energy use more tangible at the point of use
- A community arts festival on climate change, combining multiple artistic forms in a celebratory format.

These are just a few examples of ways that art might be used to engage with climate change. Artistic expression can invoke an emotional, visceral and felt experience of climate change that makes climate change real and personal rather than intangible. For many people, it will provide a more powerful expression of climate change than the objective data presented by the IPCC. To illustrate how art can deepen subjective engagement with climate change, I will give two personal examples.

Andy Goldsworthy is a British artist who creates outdoor sculptures, using natural materials found at the site (e.g. Friedman & Goldsworthy [1990] 2004; Goldsworthy 1996; Goldsworthy 2000). His works explore the human relationship with nature and issues of transience and change. Many of his works are transient, made of ice or earth or precariously balanced stones that disintegrate or change in response to the elements. They are captured through photographs that display the process of change. For example, in July 1989, Goldsworthy displayed eighteen large snowballs, created the previous winter in the Old Museum of Transport in Glasgow (Friedman & Goldsworthy [1990] 2004). Over the course of five days, the snowballs melted, revealing different materials embedded in the snow, from chalk, to pine needles, to river stones. Goldsworthy's photographs capture the different stages of the melting process. Other works in nature are photographed from the same angle in different seasons, bringing out changes in colours and quality of light through the seasons and changes in the work itself in response to wind, rain and time. I find Goldsworthy's art not only aesthetically captivating, but also expressive of the passage of time in nature. His work helps me personally to understand the power of climate change to create or destroy through the analogous action of diurnal or seasonal cycles on Goldsworthy's sculptures.

Poetry can invoke a similar response. For me, Percy Bysshe Shelley's 1818 poem *Ozymandias* (Shelley 2003) perfectly expresses the idea that human civilisations are not eternal and humans should not be so arrogant as to think that climate change does not pose a serious threat:

> I met a traveller from an antique land
> Who said: Two vast and trunkless legs of stone
> Stand in the desert...Near them, on the sand,
> Half sunk, a shattered visage lies, whose frown,
> And wrinkled lip, and sneer of cold command,
> Tell that its sculptor well those passions read
> Which yet survive, stamped on these lifeless things,
> The hand that mocked them, and the heart that fed:
> And on the pedestal these words appear:
> 'My name is Ozymandias, king of kings:
> Look on my works, ye Mighty, and despair!'
> Nothing beside remains. Round the decay
> Of that colossal wreck, boundless and bare
> The lone and level sands stretch far away.

Community support groups

While community cultural development is often synonymous with community art, I understand it as also including the establishment of community support groups and relationships that may not be based on artistic expression. Community support groups potentially have an important role in climate change response. In Section 4.8.3, I reviewed approaches that seek to establish supportive community groups to collaboratively pursue sustainable lifestyles. In Australia, the Cool Communities program was a good example, providing funding and facilitation support for communities to develop their own GHG abatement programs (AGO 2004b). This type of approach is suitable for inclusion in an integral climate change response.

Another example is the Sustainability Street approach, devised by a performance group called Vox Bandicoot in collaboration with the City of Moreland. Sustainability Street is a voluntary community development approach that brings together people from a geographic area or social group to learn about sustainability, identify local sustainability projects and act as teachers to engage others in the project of local sustainability (Vox Bandicoot 2004). Projects of this type help encourage the formation of groups driven by ecological or postmodern values. These groups can set a local example of worldcentric ethics that acts as a driver for ongoing cultural development. They provide a way for individuals to establish their identity that is not linked to conspicuous material consumption. Further, these groups are sensitive to social and cultural context and help people to solve the real sustainability problems that they face in their daily lives.

There are many actions that local support groups can take to respond to climate change, including sharing energy saving tips, engaging in fundraising to pay for energy efficiency retrofits or local installation of renewable energy, or developing artistic responses of the type discussed above. Michaelis (2003, p.S143) argues that policy needs to provide: 'Support for experimentation and learning by local communities, schools and other groups and organisations, to find new ways of promoting sustainable living'. I agree; an integral policy response should support creative experimentation by local groups as a driver for both objective and subjective development.

Groups of this sort provide a window on what a culture of climate change response might look like. They are crucial to wider cultural development as they:

> …[create] small pockets of leading-edge consciousness, [create] small pockets of "cognitive potential" that slowly but surely feed back into collective worldviews and then into social institutions themselves…and once materially embedded and institutionalized, those institutional structures automatically, as it were, act as pacers of transformation for all who follow (Wilber 2000c, p.209).

Like early adopters of technology, the early adopters of new cultural structures set the scene for all those who follow.

8.6 Conclusions

The integral climate change response proposed in this chapter combines and modifies a range of existing policy methods within a coherent theoretical framework. In general, I have focused on the development of an integral policy process, rather than trying to predict integral policy outcomes. This is an intentional focus, based on my belief that climate change response needs to arise out of creative contestation between different discourses, the results of which cannot be predicted in advance. However, I have noted my own content preferences where appropriate, such as my preference for a 450-ppmv atmospheric stabilisation target for carbon dioxide.

In the objective quadrants, an important component of the policy process is integrated assessment. Integrated assessment draws together objective knowledge in a policy-relevant form. This can occur through the application of sophisticated IA models, through the development of exploratory scenarios (with varying reliance on models) and through qualitative processes. Any process of integration, even within the objective quadrants, requires subjective decisions about what knowledge to include. To guide these decisions, public participation in IA is appropriate.

I have proposed a participatory model, consistent with integral theory, that builds on the cooperative discourse model introduced by Renn et al (1993). The model involves citizens, stakeholders, experts and an integral secretariat, drawing on the relevant expertise of each group. It comprises four steps:

1. Normative futures work to draw out and group desirable futures from citizens and stakeholders.
2. Participatory integrated assessment to assemble relevant objective knowledge, develop exploratory scenarios and assess the implications of the desirable futures identified in the first step.
3. Citizen integration of the results of the first two steps in a deliberative forum, with access to stakeholder and expert input, leading to citizen policy recommendations.
4. Social learning through communication of citizen recommendations and evaluation of the policy process.

Integral facilitation is crucial; it should aim to provide gentle developmental pressure on all participants throughout the process.

I argued that the participatory model should initially be applied within civil society, either as a research project or sponsored by a sympathetic NGO. However, the ultimate aim would be to embed such a process within the state, as climate change response requires such fundamental changes in technological, economic and institutional structures that it must become a core state imperative. As long as climate change response is seen in opposition to core state imperatives, the objective of atmospheric stabilisation will remain distant. As part of the process of changing state imperatives, I advocated the establishment of a Sustainability Commission or National Council on Sustainable Development to provide independent advice on sustainable development policy.

Although the proposed participatory model provides an effective link between objective and subjective knowledge, it does not explicitly adopt a developmental perspective. Such a perspective is critical to integral climate change response. In the behavioural quadrant, Australians need to develop behaviours that are consistent with low GHG emissions. In the systemic quadrant, the task is to develop a low-carbon informational energy system to replace the carbon-intensive industrial energy system. As policy approaches consistent with this task, I advocated evolutionary economics, an experimental or evolutionary approach to policy that prioritises adaptive flexibility, diversity and precaution and the design of institutions oriented towards social learning. These institutions would be guided by a legislated policy target, rely on feedback and evaluation, promote reflexivity and prioritise documentation and dissemination of learning.

In the psychological quadrant, policies to promote development need to create sources of dissonance or insight for individuals. I suggested constructivist learning approaches, civic participation, deliberation across difference and integral transformative practice as policies or methods, consistent with climate change response, that could initiate psychological development. Finally, in the cultural quadrant, I advocated community cultural development as a way to engage subjectivity within civil society and to insert postmodern, ecological discourse into climate policy debates.

The integral climate change response proposed here is largely theoretical. Although most of its elements have been tested in various applications and have delivered promising results, they have not been applied within the context of a coherent integrating framework. The approach outlined here should be understood as a first attempt to apply integral theory to the problem of climate change response in Australia and a suitable basis for further empirical work and testing. It is not intended as a static proposal but as a dynamic starting point for collective learning.

9. Conclusion: Futures in the Balance

> Let ours be a time remembered for the awakening of a new reverence for life, the firm resolve to achieve sustainability, the quickening of the struggle for justice and peace, and the joyful celebration of life.
>
> \- *The Earth Charter*, p.7

> In our relationship with nature, let us not drive a wedge between the intellect and experience. Rather, by embracing both…let us affirm what it means to be human in a world, if we choose wisely, of human goodness and natural splendour.
>
> \- Peter Kahn, *The Human Relationship with Nature*, p.227.

9.1 Introduction

I have two purposes in this concluding chapter. First, I seek to summarise the findings of my research by restating, and in some cases extending, my responses to the research questions considered in Chapters 2 to 8. Recall that the eight questions addressed so far are:

1. How does integral theory relate to existing conceptual approaches to sustainable futures?
2. What are the theoretical and methodological implications of integral theory for sustainable futures research?
3. How adequately does the literature on energy and climate change consider and integrate the different quadrant perspectives?
4. What behavioural, systemic, psychological and cultural perspectives need to be considered for an integral response to climate change?
5. How adequately do Australian energy and climate policy development practices consider and integrate the different quadrant perspectives?
6. Does the existing system of energy and transport subsidies in Australia create a significant market distortion in favour of fossil fuel production and consumption?
7. How can integral theory contribute to theoretical and practical understanding of environmental and climate policy discourse?
8. How can integral theory be used to improve energy and greenhouse policy development processes and outcomes in Australia?

I will consider the first question in Section 9.3, where I will build on the response I provided in Chapter 2, by proposing modifications to existing conceptual approaches to sustainable development that will improve their consistency with integral objectives. I addressed the second question in Chapter 2 by adopting integral methodological pluralism as the guiding methodology for this thesis. In Section 9.4, I present some conclusions on the demands that integral methodological pluralism places on the researcher, and ways that these demands can be managed. With the exception of the seventh question, the remaining questions deal specifically with elements of an integral approach to climate change mitigation. In Section 9.2, I address each of these questions through a summary of the integral climate change response that has emerged in this thesis. This summary includes a discussion of the challenges associated with implementation of the proposed policy process. I will consider the seventh question in Sections 9.4 and 9.5, in my discussions of the value of an integral approach and the theoretical and practical contributions of my thesis.

My second purpose in this chapter is to discuss and develop findings that relate to my original research objectives. Recall from Chapter 1 that these objectives were:

1. Elaborate the links between sustainable development, futures studies and integral theory.
2. Contribute to the theoretical development and practice of each of these fields.
3. Propose an integral approach to the task of establishing a sustainable and desirable human civilisation.
4. Test the practical value of integral theory using a specific case study of an issue that is central to existing debate over sustainable development.
5. Contribute to the integration of climate change and sustainable development discourses.

I address the first two objectives in Section 9.5, where I discuss the theoretical and practical contributions of my research. I address the third and fifth research objectives in Section 9.3, by discussing the elements of an integral approach to sustainable development that have become apparent through my case study on Australian energy and greenhouse policy. That is, I generalise those case study findings that are relevant to sustainable development policy and place climate change response within a broader sustainable development framework. I address the fourth research objective in Section 9.4, where I assess the value of an integral approach as applied to climate policy and sustainable development. In that section, I also reach some conclusions in relation to the research hypothesis I outlined in Chapter 1.

I conclude the thesis with a discussion of future research directions (in Section 9.6) and some brief observations on the human prospects for addressing the civilisational challenge (in Section 9.7).

9.2 An integral climate change response

In this section, I will briefly summarise findings from my application of integral theory to Australian energy and greenhouse policy in Chapters 3 to 8. In Section 9.2.1, I will summarise the findings of the integral literature review of energy and climate change from Chapters 3 and 4. In Section 9.2.2, I will outline the results from my critical review of Australian energy and greenhouse policy (Chapter 5), including the results of my analysis of energy and transport subsidies (Chapter 6). Finally, in Section 9.2.3, I will restate the proposed integral policy process for climate change response from Chapter 8.

9.2.1 An integral literature review of energy and climate change

In Chapters 3 and 4, I used integral theory to guide and structure a review of the energy and climate change literature. I addressed the objective literature, associated with the behavioural and systemic quadrants, in Chapter 3, and the subjective literature, associated with the psychological and cultural quadrants, in Chapter 4. I also identified literature that achieved some degree of objective and subjective integration, in Section 4.13.2.

An objective perspective was much more common in the literature I reviewed than a subjective perspective, providing support for Wilber's flatland thesis – the argument that modern Western civilisation is dominated by objective, instrumental rationality and marginalises all approaches that try to access interior subjectivity. In the objective literature, the energy sector is framed as a series of interrelated physical or conceptual systems, including energy infrastructure networks, markets, rational market participants and regulatory institutions. The appropriate response to climate change tends to be defined in the terms of the system that the author is concentrating on. Thus, technologists focus on technological solutions, climatologists on atmospheric stabilisation, economists on market instruments and social and political scientists on institutional changes. In fact, all of these responses are critical and need to be pursued simultaneously in an integral climate change response. However, I would argue that an institutional perspective is particularly powerful because it allows the analyst to adopt critical distance from the assumptions of the technological and economic systems. From this distance, the analyst can recognise technological and economic systems as simply another set of institutions. If these institutions do not meet human needs, they can be redesigned.

While certainly not as extensive as the objective literature, the subjective literature was nevertheless comprehensive in its attention to important developmental lines within the psychological and cultural quadrants. From a subjective perspective, the energy sector is framed as contested conceptual territory, occupied by competing cultural discourses, varying personal values and collective decision-making processes with varying degrees of inclusion. I identified literature on individual motivations for energy consumption and climate change response, the phenomenological experience of energy use and climate change, uncertainty, cultural influences on consumption, climate change discourses, ethics and collective decision-making as providing important perspectives for inclusion in an integral climate change response. I found the literature on discourse and collective decision-making processes most useful due to the practical insights it provides about policy processes for climate change response.

As noted above, the literature addressing the objective quadrants was more extensive than the literature addressing the subjective quadrants. Similarly, a collective perspective was more common in the literature than an individual perspective. This is unsurprising, given that climate change is a global issue requiring a collective response. While observations of individual behaviour and interpretations of individual values can certainly help in formulating that response, disciplines that address collective systems and cultures are best placed to contribute to the climate change debate.

The literature was methodologically diverse, covering seven of the eight methodological categories identified with integral methodological pluralism. Empirical work, systems theory, social autopoietic thinking, phenomenology, structural developmental theory, cultural studies and hermeneutics were all represented. I was unable, however, to identify any applications of autopoietic thinking to energy or climate change issues from a behavioural perspective.

Although there was an evident tendency in the literature to focus on one or two developmental lines within a quadrant, consistent with disciplinary specialisation, I did identify examples of work that achieved integration within quadrants. Integrated assessment work integrates multiple systems within the objective quadrants. Literature on carbon lock-in integrates technological, economic and institutional systems. In the cultural quadrant, grid-group cultural theory successfully integrates multiple lines relating to discourse, metaphor and group solidarity.

There were also several examples of work that achieved integration of objective and subjective knowledge. One example is the recent work on pro-environmental behaviour that draws on psychological, social and cultural explanations. Another is work seeking integration of climate change and sustainable development, framed as integration of objective science and ethical concerns. Other examples tended to be author-specific. Connor and Dovers (2004) integrated discourses, institutions and values in their work on institutional change. Michaelis (e.g. 2000a) draws on all quadrants in his explanations of consumption. Bulkeley (2000b) and Dryzek (1997; 2000) integrate institutions and discourses. Renn (1999) seeks integration of objective knowledge with subjective values and preferences. This integrative work provides an excellent foundation for an integral climate change response.

While the literature was comprehensive in its coverage of the quadrants, I did identify several areas that deserved further attention in an Australian context. First, there was little evidence that Australian energy and greenhouse policy processes had engaged adequately with issues of uncertainty surrounding climate change. Second, the contribution of public subsidies to the cost differential between fossil fuel energy and renewable energy in Australia had not been adequately explored. Third, there was little attention to developmental processes, particularly in the subjective quadrants. I addressed each of these gaps in subsequent chapters.

9.2.2 Australian energy and greenhouse policy

In Chapter 5, I reviewed existing Australian energy and greenhouse policy practices as the developmental starting point for any proposed integral policy practice. In Chapter 6, I examined a specific Australian policy issue within the systemic quadrant – the relative magnitude of public subsidies for fossil fuels and renewable energy. In this section, I will summarise the results from these two chapters.

Bulkeley (2000b) identifies a resource-based discourse coalition and a greenhouse action discourse coalition within the Australian climate policy network. I found supporting evidence for the existence of these discourse coalitions. The resource-based coalition prioritises economic growth and exploitation of Australia's natural resources above all other objectives. The greenhouse action coalition advocates a precautionary approach to climate change, for diverse reasons. At present, the resource-based coalition dominates policy processes and decisions and the greenhouse action coalition is effectively excluded.

The main policy processes and tools used in Australia to develop energy and greenhouse policy include economic analysis, energy projections, stock models, exploratory and normative scenarios, parliamentary and public inquiries and various consultative processes, including requests for submissions, confidential meetings and bargaining by interest groups. Policy makers are particularly reliant on energy projections and economic analysis as decision-making tools. Reliance on energy projections is problematic as the single future they depict is fragile if assumptions prove false, provides insufficient information for robust policy decisions and provides no indication of what is desirable. Reliance on economic analysis is problematic due to deep uncertainty in assessments of the cost of climate change, the use of economic modelling assumptions that conflict with empirical evidence, the unethical treatment of future generations in most economic models and the lack of transparency in presentation of modelling assumptions and results. I found that economic analysis is often used unreflectively in the realm of energy and greenhouse policy to support an unquestioned ideological commitment to economic growth, associated with modern, rational values. Thus, current applications of economic analysis tend to exclude alternative subjective values and worldviews, acting as a barrier to an integral climate change response.

Exploratory scenarios that seek to integrate multiple developmental lines within the systemic quadrant are markedly superior decision-making tools. They seek to comprehensively map possible futures, providing a basis for robust decisions that perform well across conflicting assumptions. The *Turbulent World* scenarios, reviewed in Chapter 5, are an example of an exploratory scenario approach applied in Australia. These scenarios had some specific limitations. In particular, the scenario development process offered no opportunities for public involvement and catered particularly to business interests, so the final scenarios captured only a limited range of subjective perspectives. However, exploratory scenarios have potential as a policy tool for integral climate change response. This potential is best realised when exploratory scenarios are combined with normative scenarios that seek to navigate a desirable path through the future territory.

Opportunities for public participation in policy processes are available, through public inquiries, reviews and requests for submissions. However, business interests have far greater resources to respond to these opportunities than citizens or public interest groups, contributing to the dominance of the resource-based discourse coalition. Most participatory processes do not seek to encourage discursive contestation or to provide authentic democracy by empowering citizens to direct policy. The focus is predominantly on collecting stakeholder views through individual submissions and providing information about subsequent decisions rather than stimulating debate or deliberation.

In general, I found that objective tools and methods, instrumental rationality and modern values were dominant in Australian energy and greenhouse policy. Technological solutions to climate change, particularly carbon dioxide capture and sequestration, are prioritised in Australian greenhouse policy. This is consistent with the application of instrumental rationality and the dominance of the resource-based discourse coalition, which is committed to continued exploitation of Australia's fossil fuel resources. In addition, policy makers are ideologically committed to economic growth as the central tenet of energy and greenhouse policy. This commitment is apparent in the evolution of Australia's greenhouse policy of no-regrets, described by Bulkeley (2001), and in the arguments used by the Australian Government to defend its position on the Kyoto Protocol and its long-term greenhouse policy. These arguments show no sensitivity to ethical principles. They are sociocentric arguments in which protection of the wealthy Australian lifestyle is prioritised over a worldcentric ethical responsibility to developing countries.

I found little evidence that the academic literature addressing the psychological and cultural quadrants, including work on discourse and deliberative democracy, had influenced energy and greenhouse policy practices in Australia. Australian energy and greenhouse policy practices show all the indications of being trapped in Wilber's flatland.

Even from a flatland perspective, there are evident problems with the arguments employed to defend Australian energy and greenhouse policy. In Chapter 6, I explored one of these arguments – that climate change response is too expensive because renewable energy costs more than fossil fuels. I showed that fossil fuel production and consumption received in the order of $8.5 billion in public subsidies in 2003-04, compared to just $250 million for renewable energy. While the magnitude of subsidies in the stationary energy sector is not sufficient to greatly alter the cost differential between fossil fuels and renewable energy, there were indications that subsidy removal in the transport sector could make some renewable fuels much more competitive. When combined with the exclusion of negative environmental and social externalities from the price of fossil fuels, it is clear that the assumption that renewable energy is more expensive than fossil fuels needs to be re-examined.

9.2.3 An integral policy process for climate change response

In Chapter 8, I proposed an integral policy process for climate change response in Australia. While my focus was specifically on a process suitable for application in Australia, I believe that the process has wider applicability as a policy framework for other industrialised nation-states interested in integral climate change response. Modifications would, of course, be necessary to suit specific contexts. In this section, I will briefly outline the main elements of the proposed policy process before reflecting on some of the challenges faced in implementing such a process.

Elements of the proposed policy process

Integrated assessment is the first element of the policy process. Its role is to integrate objective knowledge of human behaviour, technology, physical and ecological systems, economic systems and institutions and present that knowledge in a policy-relevant form, such as exploratory scenarios. Integrated assessment should allow for citizen participation to guide subjective decisions about assumptions and methods. Participatory IA may be employed as a policy support method in its own right and this alone would provide a substantial improvement on existing Australian policy processes. However, I believe that participatory IA can be even more effective when employed within a broader participatory model.

The participatory model I propose builds on the cooperative discourse model developed by Renn et al (1993). It provides specific roles for citizens, stakeholders, experts and an integral secretariat, consistent with their respective expertise. It comprises four steps:

1. Normative futures work to draw out and group desirable futures from citizens and stakeholders, supporting discourse analysis.
2. Participatory integrated assessment to assemble relevant objective knowledge, develop exploratory scenarios and assess the implications of the desirable futures identified in the first step.
3. Citizen integration of the results of the first two steps in a deliberative forum, with access to stakeholder and expert input, leading to citizen policy recommendations.
4. Social learning through communication of citizen recommendations and evaluation of the policy process.

The integral secretariat has an important facilitation and liaison role. Integral facilitation should seek to weave the desirable futures advocated by different discourses into a coherent set of policy recommendations, either by developing a package of policy measures to satisfy different discourses or by identifying robust policies that multiple discourses can support for different reasons. In addition to synthesising, the integral facilitator needs to design participatory processes to maximise opportunities for subjective development. This means creating opportunities and spaces for contestation, argument and challenge as a possible source of developmental dissonance and offering new knowledge and experiences (e.g. field trips or opportunities for artistic expression) as a possible source of developmental insight.

This participatory model can be applied within the state or within civil society. I believe that application within the state is appropriate, as climate change response has such far-reaching implications for economic, environmental and social systems that it must be pursued as a core state imperative. However, given current political realities in Australia, the most likely site for initial testing of the model is civil society, either through a research project or with NGO sponsorship. Civil society is also the appropriate site for creating pressure on the state to adopt climate change response as a state imperative.

The purpose of the participatory model is to link the objective and subjective in decision-making processes. Additional policy processes are required to encourage the broader objective and subjective developments required for an effective climate change response. In the behavioural quadrant, Australians need to develop behaviours that are consistent with low GHG emissions. The biological capacity for these behaviours already exists, however, development in the other quadrants is necessary to draw out these behaviours.

In the systemic quadrant, the developmental task is to develop a low-carbon informational energy system to replace the carbon-intensive industrial energy system. The informational energy system is likely to be small-scale, distributed and heavily networked. As policy approaches consistent with objective development, I advocated evolutionary economics, an experimental or evolutionary approach to policy that prioritises adaptive flexibility, diversity and precaution and the design of institutions oriented towards social learning. These institutions would be guided by a legislated policy target, rely on feedback and evaluation, promote reflexivity and prioritise documentation and dissemination of learning.

In the psychological quadrant, policies to promote subjective development need to create sources of dissonance or insight for individuals. I suggested constructivist learning approaches, civic participation, deliberation across difference and integral transformative practice as policies or methods, consistent with climate change response, that could initiate psychological development. All of these methods require further empirical testing to identify the conditions under which they are most likely to promote subjective development.

In the cultural quadrant, I advocated community cultural development as a way to engage subjectivity within civil society and to insert postmodern, ecological discourse into climate policy debates. Community cultural development uses artistic expression to make energy use and climate change tangible and to engage communities in climate change response. Community cultural development also includes the establishment of community support groups comprising individuals that are interested in climate change response. These groups provide a window on how a future culture of climate change response might look and feel.

Implementation challenges for the proposed policy process

As noted in Section 1.6.5, my intention in this thesis was to develop a theoretical policy process, consistent with integral theory, for empirical testing and refinement in future research. It is possible to anticipate in advance at least some of the challenges that might be faced during implementation of the proposed policy process. Others will presumably emerge during implementation. I will consider some of the critical challenges below.

First, it is clear that there is potential for tensions to emerge between citizens, experts and stakeholders involved in the policy process. Some experts and stakeholders will feel threatened by a process that cedes some of their decision-making responsibility and power to citizens; from the perspective of experts and stakeholders, citizens may make naïve decisions. Conversely, citizens may be suspicious of experts and stakeholders that represent particular interests. The original cooperative discourse model was designed, in part, to manage these tensions. By involving stakeholders, experts and citizens sequentially, the model seeks to limit the involvement of each group to those issues to which its knowledge is best suited. The model has been successfully applied in Europe and the United States (Renn 1999). However, it is uncertain how it will fare in an Australian context when applied to an issue as hotly contested as climate change. Further, the modified cooperative discourse model proposed in Section 8.4.3 alters the original sequential relationship between the different groups, with results that are difficult to predict. Managing any emergent tensions between experts, stakeholders and citizens will be a critical implementation challenge for an integral policy process.

Second, the selection of citizens to participate in the proposed policy process poses some challenges. As climate change has global sources and impacts, there is a strong argument that some of the citizen participants should be drawn from outside Australia, even for a process focused on Australian policy. In Section 8.5.3, I raise the possibility of establishing a deliberative forum that would bring together citizens from Australia and developing nations in the Asia-Pacific region. While such a forum would be ideal for deliberation on issues of global equity, it may be difficult to identify appropriate representation and to determine an appropriate policy focus for the forum. Establishment of a deliberative forum involving only Australian citizens is a more practical immediate goal. Further, to gain experience with the proposed integral policy process, it would be appropriate to start with a small-scale (e.g. local or regional) policy process, rather than a state-wide or nation-wide process. As noted in Section 8.4.3, citizens would be randomly selected to promote representation of the diverse interests within the locality or region.

A third implementation challenge relates to the integration of different types of knowledge within the policy process. While integral theory provides principles and guidelines for achieving integration, particularly the principles of IMP, much depends on the willingness of the participants to constructively negotiate and harness contestation and conflict towards practical outcomes. It is one of the roles of the integral facilitator to direct discursive contestation towards policy resolution. There is no doubt that this facilitation role is a demanding one. The integral facilitator must apply the principles of integral theory to encourage coordination and integration of knowledge across quadrants, while avoiding the temptation to direct discussions towards a predetermined outcome. The feasibility of this role will depend on the emergence of facilitation techniques, guidelines and rules that draw on integral theory. Research on integral facilitation is ongoing through the Integral Institute and other organisations focused on applications of integral theory. However, the demands of integration in practice may constitute a limitation on the practical value of integral theory. I return to this point in Section 9.4.3.

Finally, I must concede that the prospects for adoption of an integral policy process for climate change response within the state currently appear remote, given the nature of existing policy processes described in Chapter 5. Current policy is oriented towards continued use of fossil fuels. It is in the interest of many powerful industries to resist any change to this policy, including changes to policy processes that cede power to citizens. Faced with these powerful interests, the best hope for a more integral policy approach to climate change response may initially lie with small-scale policy processes, perhaps within state or local governments, that do not threaten these interests. Alternatively, it may be possible to gradually introduce elements of an integral policy process to national energy policy debates. Regardless, the challenges posed by the existing political economy must be faced if a serious response to climate change is to emerge in Australia.

9.3 An integral approach to sustainable development

The findings of my case study application of integral theory to climate change response have broader applicability for sustainable development policy. In this section, I will draw on the case study to suggest an integral approach to sustainable development. I will start, in Section 9.3.1, by proposing ways in which the popular three pillars and systems theory approaches to sustainable development could be made more consistent with integral theory. Then, in Section 9.3.2, I will outline the elements of an integral approach to sustainable development.

9.3.1 Building on existing approaches

In Section 1.4, I introduced several theoretical and conceptual approaches to sustainable development. From an integral perspective, these approaches are all true but partial. They capture important elements of sustainability in the objective quadrants but give insufficient attention to the subjective quadrants. Thus, it should be possible to build on these approaches rather than discard them. In this section, I will expand on the response to my first research question by examining how two of these approaches – the three pillars and natural step approaches – might be modified to improve their consistency with integral theory.

Three pillars or four pillars?

The three pillars or triple bottom line concept of sustainable development defines economic development, social development and environmental protection as reinforcing pillars that must be pursued simultaneously for sustainable development. However, as discussed in Chapter 1, this model provides little guidance for reconciling conflicts between the pillars and has little to say about subjectivity. An integral version of this model would expand the number of pillars to four, corresponding to each of the quadrants. Thus, sustainable development would require simultaneous attention to behaviour, systems, values and culture.

A developmental perspective would provide assistance in reconciling conflicts. Policies would be preferred that promote development in all quadrants and that support inclusion. In reconciling conflicts between the biosphere and the noosphere, it must be recognised that the agreement to protect the biosphere can only take place in the noosphere. Thus, while sustainable development policies should always seek to protect the biosphere, unfolding the full potential of the noosphere by resolving social and cultural conflicts will have greater priority in the short-term. The biosphere will remain under pressure as long as there is widespread poverty, inequity, conflict and misunderstanding.

Adding conditions to The Natural Step

The Natural Step approach to sustainable development, outlined by Robèrt et al (2002), uses systems theory to arrive at four system conditions for sustainability (see Section 1.4.3). These conditions are all true but partial. The first three conditions capture the idea that a system can only be sustainable, in the long-term, if it has no net inputs from the environment, no net outputs that accumulate in the environment and does not otherwise degrade its environment. These conditions all capture important aspects of sustainability from a systemic quadrant perspective and should be retained.

The fourth system condition touches upon the subjective by mentioning human needs although, as noted in Section 1.4.3, the context in which it is presented by Robèrt et al (2002) strongly suggests that the authors conceive of needs as homogeneous, empirically determinable and able to be met by simply providing the right social conditions and supporting systems. In fact, needs have a subjective dimension, and vary depending on psychological structures and social and cultural context. There is a danger that The Natural Step approach projects the needs of the authors, or of the practitioner who follows the approach, onto individuals and cultures that have very different needs. As discussed in Chapter 7, this is typical of the rational Ego, which assumes that its rational values are universal.

How then might this fourth system condition be improved? I would suggest replacing it with the following conditions:

- In the sustainable society, all people are valued and have the opportunity to participate in decision-making
- In the sustainable society, the developmental needs of all people are met.

The first of these new conditions seeks to establish equality in the form of mutual respect and authentic democracy. The second retains the theme of needs, but links these needs to a developmental process and implies that the sustainable society assists people throughout this developmental process.

It is important, for practical reasons, to have concise conceptual tools like The Natural Step framework to guide sustainable development. Expanding the number of conditions to five by adding the above conditions in place of the current fourth condition would improve the consistency of this tool with integral theory. However, there is a danger in oversimplifying the process of sustainable development by reducing it to a small number of general conditions. Integral theory provides a broader set of conceptual tools that are more responsive to context, allowing analysis of the structures that are actually present in each of the quadrants and development of a strategy that is sensitive to those structures.

9.3.2 Elements of an integral approach to sustainable development

The integral policy process for climate change response proposed in Chapter 8 and summarised in Section 9.2.3 has broader applicability to sustainable development policy. Indeed, all of the elements of the proposed policy process could be applied to other sustainable development problems, such as water scarcity, poverty, terrorism and conflict, biodiversity loss or global governance structures. Throughout this thesis, I have treated climate change as one facet of the broader sustainable development problem. Numerous authors have indicated that this perspective is rare in practice; climate change response and sustainable development discourses are often poorly integrated (e.g. Beg et al 2002; Cohen et al 1998; Michaelis 2003; Najam et al 2003; Robinson & Herbert 2001; Swart, Robinson & Cohen 2003). These authors portray the climate change discourse as overly technical and instrumental in its reliance on modelling and its framing of climate change response in terms of emission reduction. The sustainable development discourse is seen to offer greater sensitivity to social and cultural context, including issues of equity, poverty, adaptation and participation.

One advantage of an integral approach to climate change is that it guides thinking to each of the quadrants in turn, so that issues of equity, poverty, adaptation and participation cannot be ignored. Equally, if sustainable development discourse were guilty of giving insufficient attention to objective modelling, integral theory would guide attention towards this omission. Thus, integral theory provides a basis for integration of climate change and sustainable development discourses. As a comprehensive theoretical framework, it ensures that the same fundamental issues of behaviour, systems, psychology and culture are considered, whatever the specific problem.

In the sections below, I will draw out the elements of an integral approach to sustainable development by generalising appropriate elements of an integral climate change response.

Integral methodological pluralism

The first element is integral methodological pluralism, outlined in Section 2.4. The eight methodological categories of integral methodological pluralism provide the basic tools for revealing those aspects of each quadrant that are relevant to any particular sustainable development problem. An integral literature review, like that presented in Chapters 3 and 4, can identify the work that has already been done from each methodological perspective and draw attention to any gaps. This provides a suitable foundation for an integral approach to sustainable development.

The three principles of integral methodological pluralism – nonexclusion, unfoldment and enactment – provide guidance on reconciling conflicts between knowledge claims. They are a reminder to include all quadrants and levels when addressing a sustainable development problem and not to absolutise any quadrants or levels.

Participatory integrated assessment

Participatory integrated assessment is a suitable method for assembling knowledge from the objective quadrants in a form that is relevant for sustainable development policy. It has been successfully applied to sustainable development, for example in the regional Georgia Basin Futures Project (see Robinson 2003) and the European VISIONS project, investigating visions for a sustainable Europe (see Rotmans et al 2000). While the content issues will be different for a sustainable development application of IA, the process is essentially the same as that I have outlined in Chapter 8.

Vision and foresight

In the proposed participatory model in Chapter 8, the first step is normative futures work. In Chapter 8, I particularly stressed the role of normative futures work in drawing out subjectivity, expressed in the form of desirable futures. However, normative futures work is also vital for providing a vision to guide and inspire a society. For climate change response, I suggested the establishment of an atmospheric stabilisation target to guide policy and investment. For sustainable development, a broader vision is required that expresses the normative aspirations of humanity. Without such a vision, sustainable development policies will easily fall prey to short-termism and reactive management of problems without ever addressing the deep objective and subjective factors that prevent sustainability. These factors, which include systemic inequity, cultural inequity and a rampant material culture fuelled by the dominance of the rational Ego, can only be addressed through long-term cooperation guided by vision. Visioning is a 'powerful tool for escaping from the confines of ideas and paradigms that lock us into many undesirable patterns of behaviour and practice' (Mebratu 1998, p.516).

The use of normative futures work, guided by integral theory, to establish a shared vision for sustainable development may also go some way to combating the accusations of vagueness that continue to be applied to sustainable development. The establishment of a shared normative vision for sustainable development requires societies to identify specific goals and objectives so that progress toward realisation of the vision can be measured. This process establishes sustainable development as a specific set of measurable goals rather than a vague undefined concept. Integral theory provides conceptual clarity for this process by establishing a coherent theory of sustainable development and clear principles, such as those outlined in Section 8.2. Thus, integral theory links normative vision to practical action. It does not merely call for new values – it guides policies for promoting the subjective development of values through creation of dissonance and insight.

Related to vision is the concept of social foresight, explored by Slaughter (2004). While individuals routinely apply foresight in their daily lives, the capacity for broader social foresight remains undeveloped. Slaughter sees social foresight as an emerging capacity that allows societies to perceive possible futures and respond to them. In his words, 'foresight in the early twenty-first century means consciously working to complete the transition to a more sustainable world while there is time to achieve it and the future remains open' (Slaughter 2004, p.222). A vision of a desirable future is part of foresight, but foresight also includes the ability to anticipate and respond to dystopias. Both capacities are crucial to sustainable development.

In the participatory model proposed in Chapter 8, it is the role of participatory integrated assessment to provide foresight by developing exploratory scenarios and assessing the consequences of different normative futures. However, there is also a broader role for dedicated Institutions of Foresight, which are 'purpose-built organizations that focus on one or another aspect of futures work' (Slaughter 2004, p.200). These organisations would routinely apply foresight and futures thinking to civilisational problems. It would be appropriate to establish the Sustainability Commission or National Council for Sustainable Development I proposed in Section 8.4.5 as an institution of foresight.

Authentic democracy

The participatory model I proposed for climate change decision-making in Chapter 8 is equally suited to decision-making on other sustainable development issues. From an integral perspective, participation by multiple discourses is crucial to sustainable development. Apart from being a normative democratic ideal, multiple perspectives can be understood as a resource for policy development, providing a source of diversity from which solutions can emerge. This is essentially the perspective of post-normal science – that extended facts and extended peer communities will lead to better scientific knowledge.

Of course, the participatory model I have proposed is only one possible model and it requires further empirical testing. There are many other participatory models that can potentially deliver broader discursive participation. Whatever model is used, the normative objective is democratic authenticity. That is, discursive participation must be more than symbolic; all important discourses should have a real opportunity to influence the direction of sustainable development policies. However, participation alone is not sufficient for an integral approach to sustainable development; it is more consistent with postmodern values. To move to integral values, multiple discursive perspectives need to be woven together. This occurs first through discursive contestation and second through integral leadership, discussed in the next two sections respectively.

Discursive contestation

The participatory model proposed in Chapter 8 is designed to encourage discursive contestation. All discourses have assumptions, many of which may be unconsidered or unrealised. When discourses engage in argument and confrontation, these assumptions are challenged and members of the discourse must assemble a considered defence of their assumptions or abandon them. This is the essence of deliberation. Ideally, discursive contestation will provide a source of dissonance and/or insight to drive subjective development. However, even if subjective development does not result, discursive contestation brings discourse assumptions and preferences to the surface. This act of making discourse assumptions known is the starting point for integration; it reveals the structure of the discourse, allowing discourses to be related developmentally. For sustainable development to proceed, the deep clash of worldviews that becomes evident through discursive contestation must be addressed.

Integral leadership

Once discursive structures and assumptions are revealed through discursive contestation and confrontation, it is the role of integral leadership to identify robust policies that are sensitive to the needs of all discourses while ultimately seeking development and inclusion. In Chapter 8, I outlined an integral facilitation role as part of the proposed participatory model. This is one form of integral leadership. The integral facilitator is skilled in analysis of discourses and other subjective structures and can apply vision-logic to identify policies and solutions that multiple discourses will support, even if their reasons for that support are different.

Integral leadership can take a less direct form. In Section 8.5.4, I discussed the way in which community support groups committed to climate change response can set an example of a culture of climate change response that others will gradually adopt. The same thinking applies to the emergence of integral culture. Pockets of integral culture, in particular organisations or communities, provide integral leadership by example. Similarly, examples of sustainable development provide leadership by example. Thus, it remains important to identify sustainable development success stories and disseminate them as examples of how sustainable development might work in practice.

In Section 4.13.2, I quoted Michaelis (2003, p.S143) on leadership. The quotation is worth repeating here, because it perfectly captures the role of integral leadership:

> To survive in a complex, rapidly changing world, an organisation needs to be flexible and to have effective mechanisms to innovate and learn…The role of leaders is increasingly to establish and facilitate the learning process. A key feature of successful leaders is that they are not attached to a particular worldview or cultural frame. They can cope with diversity, having a facility for seeing the world from others' points of view. They recognise the value of different perspectives, and are able to manage the interaction between them. They are also willing to reflect on their own behaviour and to learn from others.

One of the central questions for sustainable development is how to embed this type of integral leadership in global governance structures. This is not something I have sought to investigate in my research. It would be a suitable topic for further research.

Evolutionary policy approaches and social learning

In Section 8.5.2, I discussed evolutionary policy approaches and the design of institutions to facilitate social learning. The principles outlined there in the context of climate change response are equally applicable in the context of sustainable development. Evolutionary economics, and ecological economics more broadly, offer great potential for sustainable development. The conflict between economic and environmental objectives remains central to the sustainable development discourse. Evolutionary economics partially addresses this conflict by introducing a developmental orientation to analysis of economic systems. Ecological economics goes further by placing ecological boundaries on economic systems. The reform of economics through application of ecological and evolutionary thinking is one of the highest priorities for sustainable development, given the negative impacts of existing neoclassical economic systems.

Extending beyond the realm of economics, an evolutionary approach to sustainable development policy means identifying and building on successes, prioritising adaptive flexibility and robust policies, promoting diversity in policy responses and adopting precaution in response to deep uncertainty. It also means designing the institutions that implement policy so that they are open to social learning. This means establishing clear policy targets to guide implementation and evaluation, adopting the principle of subsidiarity as a way of encouraging local autonomy and diversity, building feedback mechanisms and evaluation opportunities into policies, promoting a reflexive orientation within institutions and ensuring that important lessons are documented and disseminated.

Constructivist education

The constructivist approach to education discussed in Section 8.5.3 also applies to sustainable development education. Kahn (1999) shows that the development of an ecological or worldcentric ethics requires more than just environmental education. It also requires that people – children and adolescents in particular – be exposed to positive experiences of nature and sustainable development from which they can construct their own knowledge and meanings. As Kahn (1999, p.225) puts it:

> It is not enough…to provide urban children with good environmental education. We must also provide urban children with a good environment. Our cities need to be designed with nature in mind, in view, and within grasp…[We] need daily contact with nature not only for our physical but psychological well-being…[Such] contact needs to be enhanced by our buildings and physical infrastructure.

This requires a view of education as something that occurs everywhere and continuously through experience, not as something that only occurs in classrooms or through education campaigns. Thus, constructivist education for sustainable development requires a broader commitment to designing sustainable cities or, at least, examples of sustainable neighbourhoods that can teach people what sustainable development means in practice. Bringing nature into the cityscape through development of urban parks, community gardens and buildings that integrate ecological components is a high priority for sustainable development.

Community cultural development

If sustainable development is to effectively engage subjectivity in civil society, and I believe this is necessary if sustainable development is to become a core state imperative, then community cultural development should be part of sustainable development policy. Engaging communities through artistic expression and facilitation or funding of community support groups is vital to give sustainable development cultural significance and to support the emergence of worldcentric awareness. The ultimate aim is to develop cultures in which sustainable development is simply the norm.

Community cultural development is already recognised as an important element of sustainable development in Australia (e.g. Hawkes 2001). The contribution of integral theory is to give cultural development equal standing with the systemic development that is more commonly the focus of sustainable development policy. In fact, in many ways, cultural development is more important than systemic development at present as it is only by reaching mutual agreement within cultural groups to pursue sustainable development that the will to make difficult systemic changes will emerge. In Section 8.5.4, I suggested some specific ways in which policies could promote community cultural development in the context of climate change. These suggestions are equally applicable to broader sustainable development policies.

Spirituality

Those who are familiar with Wilber's work will be aware that spirituality suffuses his conception of integral theory and may wonder why I have said so little about spirituality in the course of this thesis. Wilber (2000a, p.9) believes that:

> …evolution is best thought of as Spirit-in-action, God-in-the-making, where Spirit unfolds itself at every stage of development, thus manifesting more of itself, and realizing more of itself, at every unfolding. Spirit is not some particular stage, or some favourite ideology, or some specific god or goddess, but rather the entire process of unfolding itself, an infinite process that is completely present at every finite stage, but becomes more available to itself with every evolutionary opening.

This belief helps to explain the normative commitments of integral theory. If 'Spirit' becomes more aware of itself through development, then development is to be encouraged. If 'Spirit' is present at every stage of development, then all stages of development should be included and cared for. This type of spirituality entails a worship of life and the process of its unfolding in the universe, rather than any specific deity or belief.

I personally find this spiritual dimension of integral theory inspiring. However, I am aware that many people have different beliefs and may reject those advocated by Wilber. I have avoided discussing spirituality in this thesis to separate the important theoretical and academic contributions of integral theory from association with a particular spiritual orientation that may not be shared. It turns out that the most pressing contributions of an integral approach to the current civilisational challenge do not require the widespread embrace of a particular spirituality. At present, the highest priorities are to:

- Redesign institutions so that they give voice to multiple discourses and values, whatever their spiritual orientation
- Promote subjective development and the widespread emergence of postmodern ecological awareness
- Develop pockets of integral leadership to provide an example of integral sustainability.

However, there is evidence that particular spiritual practices, such as meditation, can contribute to individual subjective development (Wilber 2001, p.138). Rather than advocating any specific spiritual orientation, I advocated integral transformative practice in Section 8.5.3. Integral transformative practice provides space for diverse physical, emotional, mental and spiritual practices. It is essentially about exercising human abilities in all possible spheres, thereby increasing the experience of reality and maximising opportunities for subjective development. I believe that such practice is important for achieving sustainable development.

9.4 Assessing the integral approach

As discussed in Section 1.6.2, one of my objectives in this thesis was to test the practical value of integral theory using a case study on climate change response, which is an issue central to debate over sustainable development. My hypothesis was that an integral approach offers a better orienting framework for human civilisation than existing frameworks, with the potential to guide creative and innovative solutions to the civilisational challenge outlined in Section 1.2. In general, I believe that my research has confirmed this hypothesis at a theoretical level. However, there are aspects of integral theory that I find problematic. In this section, I will review positive and negative findings related to integral theory that have emerged during my research. In Section 9.4.1, I will provide some comments on the demands that integral methodological pluralism places on the practitioner. In Section 9.4.2, I will summarise the major insights provided by the integral approach. Finally, in Section 9.4.3, I will outline some practical limitations of integral theory that emerged during the research.

9.4.1 The demands of integral methodological pluralism

Integral methodological pluralism is a demanding approach. A typical undergraduate university education does not provide sufficient grounding in each of the eight methodological categories to allow application of IMP. For those trained in the natural sciences, engineering or economics, the methods of the intentional quadrant and cultural quadrant are quite alien. Indeed, the autopoietic methods in the behavioural and social quadrant will also be alien to most from these disciplines. Those trained in the social sciences have some advantages, as a social science education typically grapples with the assumptions underlying objective methods, as well as those underlying subjective methods. Nevertheless, the details of many objective methods may be alien to social scientists. Further, a modern tendency towards academic specialisation means that even social scientists will tend to concentrate on one or two of the eight methodological categories in IMP.

Therefore, any practitioner who wishes to apply IMP has two broad options. The first is to undertake an arduous course of research and study to learn about the unfamiliar methods, their history, their assumptions and their theoretical commitments. This is the path I have taken for my research. I have found this path extraordinarily rewarding, at times providing almost daily insights into the nature of reality. However, my choice of this path has extended the duration and intensity of my research well beyond what I initially anticipated. While I advocate this path for the insights it provides, I would not expect it to gain widespread popularity as a research approach, given the demands it places on the practitioner. More importantly, no individual can hope to master more than a tiny fraction of the knowledge held by the various epistemic communities (Norgaard 2004, p.233). Disciplinary specialisation still offers many advantages in terms of depth of knowledge.

The second option, then, is to assemble an interdisciplinary team that is collectively familiar with the eight methodological approaches of IMP. While I have not yet attempted such an approach, I believe that it will prove preferable as a way of reducing the demands on any individual practitioner, increasing the depth of understanding of each method and providing for synergistic interactions between team members. I would describe such a team as transdisciplinary, in the sense that it draws together researchers from different disciplines, but uses the integral framework to transcend the contributions of any one discipline. The integral climate change response proposed in Chapter 8 could not be implemented without the support of a transdisciplinary team whose expertise spans the quadrants. This second approach requires sufficient familiarity with integral theory to contextualise disciplinary methods, rather than familiarity with all eight methods.

Regardless of which approach is attempted, the application of a meta-paradigmatic practice like IMP requires a particular kind of cognitive approach. The experience is one of searching for patterns, relationships and consistencies across diverse material. It is a search for resonance between bodies of theory that may seem, at first glance, to have little in common. It requires the practitioner to think and feel at the same time as a way of accessing objectivity and subjectivity. The skills are quite different to the rote learning and compartmentalisation of knowledge that is common in most school and university curricula. This implies that IMP demands new forms of teaching that emphasise integration and synthesis skills.

9.4.2 The insights of the integral approach

Integral theory and integral methodological pluralism offer many insights that are relevant to climate change response and sustainable development. First, as discussed in Chapter 2, integral theory provides epistemological and theoretical grounding for sustainable development. It provides a basis for identifying the important dimensions of sustainable development as well as a coherent theory of how development occurs. Consequently, integral theory has much to offer an emerging sustainability science. In particular, it can provide conceptual clarity to combat claims that sustainable development is a vague concept.

Second, integral theory gives voice to a wider call for knowledge integration that is evident across many fields. This call for integration appears, for example, in much of the social science literature addressing sustainable development (see Section 1.4.2), in work calling for integration of climate change and sustainable development (see Section 3.8.1) and in the discourse approaches reviewed in Section 4.9. However, integral theory is original in its explicit identification of the objective and subjective (and individual and collective) as equally important dimensions of any holon. It provides a theoretical basis for advocating greater attention to the social sciences, and subjectivity in particular, in climate change response and sustainable development. The integral quadrants encourage attention to four different perspectives on any problem and this broader view can provide important insights into the nature of the problem. I found the quadrants particularly useful as a theoretical guide for identifying, selecting and relating the extensive literature on climate change response.

Third, the developmental aspect of integral theory provides insight into the nature of climate change response and sustainable development. It reveals subjective development of values and worldviews as a high priority for effective climate change response and sustainable development. This has practical implications for policy direction, encouraging more attention to policies that promote personal transformation and cultural development. The integral theory of development also introduces rigour to theories of sustainable development, most of which give surprisingly little attention to the nature of developmental processes. This also has policy implications, encouraging an evolutionary approach to policy and attention to social learning.

Fourth, the eight methodological categories and three principles of integral methodological pluralism provide methodological guidance. While I did not attempt to apply all eight methods, I did search for applications of each method in the energy and climate change literature. This directed my attention towards literature I may otherwise have overlooked. Further, the principles of integral methodological pluralism provided guidance for resolving conflicts within the literature. I found the principle of nonexclusion particularly useful for encouraging a critical but constructive attitude. When applying this principle, I was always conscious to look for both the valuable contributions and the limitations of any piece of literature. Integral methodological pluralism also points to a particular methodological approach for emerging applications of integral theory. This approach starts with a literature review to identify gaps across the quadrants, fills any critical gaps in the literature and only then attempts synthesis and integration.

Finally, the attention to subjectivity and development encouraged by integral theory draws attention to multiple discourses that are relevant to any policy problem. Participatory policy approaches are required if the valid insights of these discourses are to be included in decision-making. Integral theory points towards particular types of participatory approach that encourage discursive contestation as a potential trigger for subjective development. Its normative commitments are broadly similar to those of deliberative and discursive theories of democracy. The important benefit of integral theory is that it provides guidance for relating different discourses developmentally using a combination of discourse analysis and developmental theory. Thus, in a participatory process guided by integral theory, the goal is not just to hear from multiple voices but also to gently encourage subjective development and use facilitation to encourage perspectives that are more inclusive or complex.

9.4.3 The limitations of the integral approach

I believe the insights provided by integral theory justify its wider application to sustainable development problems. However, I do not accept integral theory uncritically. During the course of my research, I have identified several limitations of an integral approach, which I will summarise below. None of these limitations is serious enough to prevent further application of integral theory, however, they do require attention by integral theorists and practitioners.

The quadrants in practice

At the heart of integral theory, underpinning the quadrant model of reality, are two theoretical distinctions. The first is between the objective and subjective, or exterior and interior perspectives. The second is between the individual and the collective. I have found the first distinction to be of much greater practical value in this thesis. It is a failure to include subjective perspectives in policy development processes that is most evident from my research, rather than any failure to include individual or collective perspectives. Consequently, the policy proposals I have outlined in this thesis are primarily designed to integrate the objective and the subjective in climate change response and sustainable development policy.

There are several reasons why I have found the distinction between objective and subjective perspectives more useful than that between individual and collective perspectives. The first is related to my choice of research topic. I am interested in sustainable development, which *requires* collective political action. Further, I am interested in practical policy proposals, which can only be implemented by changing collective institutions and worldviews. As a result, my research tends to focus on the collective quadrants rather than the individual quadrants. From a collective perspective, the distinction between the objective and subjective remains strong and valid.

Second, the distinction between the objective and the subjective is relatively common in the literature, albeit expressed in many different ways. When reporting results of my research in different disciplinary contexts, I have found that the distinction between the objective and subjective, and the marginalisation of the subjective, resonates with audiences as an important dimension of the civilisational challenge. The distinction between the individual and collective, although valid, is not recognised as an important aspect of this challenge.

Finally, and perhaps most importantly, I believe that the theoretical distinction between the objective and subjective is stronger than that between the individual and collective. There is little doubt that the exterior look of a holon is very different to the interior feel of a holon. By comparison, the boundaries between the individual and collective seem less distinct. From an objective perspective, individual holons are embedded in collectives and their behaviour may be very difficult to separate. From a subjective perspective, the individual frames their thoughts using a collective language, shaped by culture. It becomes very difficult to clearly delineate where the individual ends and the collective begins. This is not to say that the theoretical distinction is not valid and useful, but that it lacks the conceptual strength of the distinction between the objective and subjective. It is unsurprising, then, that I have found the latter distinction to have more explanatory power in my research.

There are some indications that Wilber also understands the distinction between the objective and subjective as stronger than that between the individual and collective. Wilber often treats the behavioural and systemic quadrants together (e.g. Wilber 2000c, p.446), recognising that their language is very similar and that systems theory, which examines both collective systems and individual components of systems, can be used to examine both quadrants (Wilber 2001, pp.153-154). Elsewhere, Wilber (2003a, Part V) notes that behavioural and psychological methods 'are, in one sense, naïve' as they 'tend to assume that individuals stand alone' when in fact they are part of larger objective and subjective wholes.

I would conclude that the distinction between the individual and collective is less important than the distinction between the objective and subjective for practical applications of integral theory to climate change response, sustainable development and broader policy applications. It is, however, theoretically valid and useful for design of particular policies that seek to encourage individual psychological development.

Integration in practice

As discussed in Section 9.2.3, although the three principles of IMP provide theoretical guidance on integration of competing epistemologies, knowledge claims and discourses, the practical value of these principles remains largely untested. It is certainly possible that a situation might arise in practice where representatives of a particular discourse are unwilling to limit the validity of their knowledge in such a way as to provide space for competing knowledge claims, as required by the principles of nonexclusion and unfoldment. It remains unclear how the resulting conflict might be managed or resolved.

The integral policy process proposed in Chapter 8 includes two elements designed to address integration in practice. First, citizen deliberation and discursive contestation during participatory integrated assessment is intended to support processes of negotiation between people adopting conflicting perspectives. Second, the integral facilitation role is intended to provide guidance on how to balance competing knowledge claims using the framework provided by integral theory. It was not an objective of this thesis to test the effectiveness of these elements through empirical testing. However, such testing is clearly a high priority for future research (see Section 9.6). To a large extent, the value of integral theory in policy applications rests on the success of these or alternative methods for achieving integration in situations of conflict. In advance of further empirical testing, it remains uncertain whether the practicality of integration constitutes a limitation of the integral approach.

Integral theory and elitism

A possible criticism of integral theory is that its ranking of particular developmental structures as more inclusive, complex or adequate than others encourages elitism. Integral theory clearly states that all perspectives are equally valuable but that, due to the transcendence and inclusion inherent in developmental processes, perspectives that emerge later in the developmental process are more inclusive than earlier perspectives. I believe the empirical evidence for this view is overwhelming. However, while Wilber is very careful to distinguish between healthy natural holarchies in which all people are equally valued and unhealthy hierarchies in which the upper levels dominate the lower levels, there is potential for misinterpretation or abuse of the theory. Integral theory could be used to support the establishment of an intellectual or spiritual elite that claims to be more developed and therefore to have right of leadership. It could also be used to unfairly categorise or marginalise people. None of these applications have any support in the integral work that I have reviewed. Nevertheless, it is important to be aware of the potential for abuse and to proceed with caution.

In defence of integral theory, I would note that all theories have potential for abuse and this is not sufficient reason to abandon a theory, particularly one with the evident explanatory power of integral theory. Cautious and sensitive application of integral theory, with transparent peer review processes, offers great potential for meeting the civilisational challenge. Further, in weighing the advantages and disadvantages of integral theory as an organising theory for human civilisation, it is appropriate to undertake comparison with the existing situation. The dominant neoclassical economic theories underpinning Western society contribute to widespread poverty and inequity that deprives many billions of people of the right to develop their full potential. Integral theory offers an alternative with great potential to address existing problems.

Beyond integral theory

Integral theory is sometimes criticised for arrogant and utopian assumptions. It is said to be arrogant in its assumption of universality and utopian in its assumption that adoption of integral theory will solve the problems of humanity. It is worth addressing each of these criticisms in turn to assess their validity.

Integral theory does not claim to be comprehensive and universal. A more accurate depiction of the theory is that it adopts universality as an objective. That is, integral theory seeks to include all valid perspectives that have emerged to date. Although it may achieve this objective imperfectly, this only means that the theory will need to develop over time. Wilber (2002, Sidebar G, Part V) is fully aware of this requirement:

> Even if we produce what we feel is a perfectly integral model at this time, a hundred years from now, a thousand years from now, a million years from now, our 'complete system' will look something like a flea on the elephant of the system that the future will disclose. Of course our systems are always partial, and of course new ones will always dwarf our discoveries. But we persist in attempting to be as integral as we can be at this time, because even a little bit of wholeness is better than none at all.

Thus, integral theory does not assume universality. It remains open to revision as necessary to improve the comprehensiveness and inclusiveness of the theory.

The argument that integral theory is utopian is perhaps more serious. In defence of integral theory, I would note that Wilber is quite clear in his writing that development brings the potential for new pathologies and new problems. There is never any final, blissful state when all problems are solved. At this time, integral theory is primarily an attempt to solve one of the most pressing problems facing humanity – the inadequate attention to subjectivity and subjective development. If this problem is solved, new ones will arise about which integral theory in its present form may have little to say.

Nevertheless, it is appropriate to question whether the integration across disparate fields and perspectives sought by integral theorists is realistic given the existence of power structures and relationships that actively work against integration and subjective development. This question can only be settled by further research examining practical applications of integral theory. Even if the charge of utopianism is found to have some weight, I am not convinced that this is a negative aspect of the theory. I share Oscar Wilde's ([1891] 1997) view that:

> A map of the world that does not include Utopia is not worth even glancing at, for it leaves out the one country at which Humanity is always landing. And when Humanity lands there, it looks out, and, seeing a better country, sets sail. Progress is the realisation of Utopias.

If integral theory is utopian, it shares that characteristic with the notion of sustainable development. Like sustainability, the inclusion and integration contemplated by integral theory may be impossible, but remains a worthy goal.

In general, I would argue that the potential benefits of integral theory significantly outweigh the limitations at this point in time. While it is certainly wise to proceed with caution in the application of integral theory, I conclude that it offers a superior orienting framework for human civilisation at this point in time.

9.5 Theoretical and practical contributions

In this section, I will briefly summarise the main theoretical and practical contributions of the thesis. I believe I have successfully addressed each of the research objectives and research questions outlined in Chapter 1, as well as providing support for the hypothesis that integral theory provides a superior orienting framework for human civilisation than existing dominant theories. Below, I will list specific contributions.

In Chapter 1, I reviewed two bodies of literature that are relevant to a thesis in sustainable futures – the sustainable development literature and the futures literature. I found that the normative commitments of the sustainable development and futures literature were very similar; both were concerned with the long-term sustainability of a desirable form of human civilisation. However, the futures literature had given significantly greater attention to the subjective nature of that desirable civilisation than the sustainable development literature. Within the futures literature, I identified an emerging field of integral futures work that drew on integral theory to integrate objectivity and subjectivity using a developmental perspective. I argued that integral theory had the potential to address the limitations of popular conceptual approaches to sustainable development by introducing coherent theories of subjectivity and development.

In Chapter 2, I summarised the aspects of integral theory that are relevant to sustainable futures and drew out implications for theories of sustainable development. I contributed to an emerging sustainability science by providing a theoretical basis for identifying the important dimensions of sustainable development and a coherent theory of how development occurs. In addition, I identified a general method for practical application of integral theory to a specific policy problem. This method involves three steps. The first step is to undertake an integral literature review, using the quadrants and developmental lines of integral theory to structure the review and provide categories. This review identifies existing work that needs to be included in an integral approach. The second step is to identify any crucial gaps in the literature that need to be filled before integration can proceed. The third step is to undertake integration and synthesis, guided by the principles of integral methodological pluralism. This generic method should be widely applicable in areas where integral theory is being applied for the first time.

In Chapters 3 and 4, I undertook an integral literature review on energy and climate change, consistent with the method outlined above. My main contribution in these chapters was review and synthesis of literature according to the novel structure provided by integral theory. This provided some particular insights, such as the predominance of objective literature relative to subjective literature and the omission of a developmental perspective from work in the subjective quadrants. I believe the use of integral theory to provide guidance for a literature review adds significant value by providing transdisciplinary integration. Integration and synthesis of literature across disciplines is rare as a consequence of disciplinary specialisation. Particularly rare is integration across the natural and social sciences. The significant space devoted to literature review in this thesis is indicative of the importance I allocate to synthesis and integration as a foundation for the application of integral theory. Without a truly holistic map of the human predicament, it is difficult to develop the wisdom and foresight required to navigate a desirable path into the future.

In Chapter 5, I undertook a critical review of Australia's energy and greenhouse policy to provide a foundation for the development of an integral policy approach. I found that the attention to subjectivity that was evident in the academic literature on energy and climate change had not penetrated Australian policy practice. Objective tools and methods were the dominant source of policy advice and a resource-based discourse coalition, applying an instrumental form of rationality, dominated decision-making. There was little apparent attention to subjectivity, uncertainty or inclusion of multiple discourses within the dominant policy practices.

In Chapter 6, I addressed a specific research gap within the systemic quadrant by identifying the magnitude and distribution of energy and transport subsidies in Australia. I found that fossil fuels received substantially more public funding than renewable energy sources. In the specific case of road transport, it appeared that subsidy removal would make some renewable transport fuels competitive or close to competitive with petroleum-based fuels. An important contribution of this chapter is to demonstrate that the cost differential between fossil fuels and renewable energy is not due solely to any natural advantages of fossil fuels – it is at least partly created through the institutional design of economic systems and historical path-dependent processes.

In Chapter 7, I developed meta-discourse analysis as a new method for applying integral theory to the cultural quadrant. Meta-discourse analysis is the process of reviewing and comparing discourse analyses by other authors to identify the developmental structures underlying discourse descriptions, developmental relationships between discourses and consistency across discourse descriptions by different authors. Using this approach, I demonstrated that discourses identified by three different authors, with relevance to climate change, could be reinterpreted as combinations of subjective structures recognised by integral theory. This allowed the discourses to be related developmentally, providing a way to identify which discourses should be preferred in cases of conflict. I showed that integral theory had greater explanatory power than grid-group cultural theory due to its ability to explain how discourses arise and why some discourses are more inclusive than others.

In Chapter 8, I proposed an integral policy process for climate change response, with wider applicability to sustainable development policy. I proposed a modified version of the cooperative discourse model, consistent with integral theory, as a way of integrating objective and subjective knowledge in decision-making processes. I also identified diverse methods to encourage engagement with subjectivity within civil society, including community cultural development and constructivist education. Further, I identified methods to embed an evolutionary approach to policy development across the quadrants. The proposed integral policy process is a theoretical response to integral theory and will require further empirical testing and refinement through future research.

Throughout the thesis, I have sought to initiate a process of engagement between integral theory and more established fields, including sustainability science, systems theory, grid-group cultural theory and democratic theory. If integral theory is to achieve its objectives, it must open itself to critique from established disciplines in the hope that both will gain from the engagement. I have sought to make integral theory accessible, to make its practical applications clearer and to focus on immediate priorities rather than the more esoteric aspects of the theory. I hope that the thesis makes a useful contribution to an emerging field of integral sustainability.

9.6 Future research directions

I see this thesis as the first step in an ongoing project of elaborating and testing the practical applications of integral theory in the context of sustainable development. As I have noted in several sections, the work in this thesis is predominantly theoretical; I felt that the immediate priority for the ongoing development of integral theory was to draw out its theoretical applications for established fields of inquiry. While most of the elements of the integral approach proposed here have been tested in various applications and have delivered promising results, they have not yet been applied within the context of a coherent integrating framework. A practical application of the participatory model and broader integral climate change response proposed in Chapter 8 is a particularly high priority. Application of the proposed integral policy process would allow evaluation and refinement of the theoretical framework. Further, it would allow critical testing of the practical application of the principles of IMP, which is only possible through a participatory process that provides space for diverse values and perspectives to emerge. The approach outlined in this thesis should therefore be understood as a first attempt to apply integral theory to the problem of climate change response in Australia and a suitable basis for further empirical work and testing. It is not intended as a static proposal but as a dynamic starting point for collective learning.

In addition to a practical application of the integral policy process, I have identified several other high priorities for future research. These include:

- Application of the methodological approach developed in this thesis to other issues that are central to sustainable development, such as water scarcity, biodiversity depletion, land degradation, poverty in the developing world, terrorism and global governance structures
- Detailed analysis of subsidies to public transport, cycling and walking to allow direct comparison with road transport subsidies
- Detailed modelling and analysis work on options for removal of perverse energy and transport subsidies
- The use of integral theory to guide direct discourse analysis focused on energy and climate policy (i.e. use interviews and documentary material to directly identify the subjective structures that are apparent in the Australian energy and climate policy network)
- Application of meta-discourse analysis and integral theory to environmental discourse typologies other than Dryzek’s (1997) to test the wider applicability of the method for identification of discourse correlations and underlying subjective structures
- Comparison of alternative theories of organisational and social learning with the constructivist approach to learning implied by the integral theory of development

- Further exploration of the factors that influence subjective development, particularly the conditions under which public participation, constructivist education, community cultural development and integral transformative practice are more likely to promote positive subjective development
- Design of an international policy framework for climate change response to appeal to multiple discourses
- Investigation of the roles of local governance, civil society, nation-states and global governance structures in sustainable development, using an integral framework.

9.7 Futures in the balance

I began this thesis with some very broad questions (see Section 1.2.2). I asked why, despite the emergence of environmentalism and sustainable development, have we made so little progress towards a sustainable and desirable human civilisation? My conclusion, following Wilber, is that there has been too little attention to subjectivity and processes of subjective development by environmentalists and advocates of sustainable development. At present, most people simply do not perceive sustainability problems, or do not care enough to change their lifestyles. Those who do care about sustainability lack access to policy development forums. Until we can find a way to support subjective development and authentically include diverse subjective perspectives in decision-making processes, the prospects for sustainable development appear dim.

An integral approach does not provide solutions to the numerous crises that humanity faces in the 21st century. It is no magic bullet or miracle cure and, like all theories, it has important limitations. However, I believe it provides a more comprehensive and balanced map to guide the search for solutions to the civilisational challenge. Further, it offers a way to reinvigorate the concept of sustainable development by providing it with a sound theoretical basis and combating accusations of vagueness. Whether integral theory will provide an adequate map for sustainable development in the longer term remains to be seen. No doubt, human insight will continue to develop and new maps will appear that transcend and include the insights of integral theory. However, for the moment, integral theory seems to offer the most promising framework for effectively responding to climate change and pursuing sustainable development.

The call for integration of objective and subjective knowledge is widespread in the sustainable development, climate change and futures literature, albeit not always explicit. It stems from a realisation, arrived at in many different ways and from many different directions, that human civilisation is somehow out of balance. For some, it manifests as a sense that we took a wrong turn at some point and lost our connection with nature. For others, it is a sense that we are careering blindly into the future with eyes only for the immediate, the now and the material. For still others, it is a hollowness or shallowness beneath the superficial appeal of a world of glittering surfaces.

Integral theory provides an explanation for this feeling of imbalance. When the modern differentiation of the objective quadrants from the subjective quadrants slid into unhealthy dissociation, humanity did take a wrong turn of sorts. According to integral theory, the solution is not to regress back to nature but to develop forwards within culture. With the dominance of an instrumental form of rationality, there is indeed a focus on immediate material gain. The solution is to promote subjective development to post-rational cognition. With the modern marginalisation of subjectivity, there is indeed hollowness beneath the surface of civilisation. Wilber captures this hollowness, this flatness, with his notion of flatland. The solution is to integrate subjectivity into the structures of civilisation. As Wilber (2000a, p.307) puts it: 'a new form of society will have to evolve that integrates consciousness, culture, and nature, and thus finds room for art, morals, and science – for personal values, for collective wisdom, and for technical knowhow'.

The solutions proposed by integral theory are about finding a new sense of balance that includes objectivity and subjectivity within a developmental perspective. Of course, as soon as we find this new balance, new problems will emerge and a new balance will be required. Balancing must become a continuous practice that lasts as long as development continues. We humans are like tightrope walkers on a rope that climbs higher and higher. As long as we maintain balance, we climb onwards and upwards and the higher view opens up new vistas. But as we climb, the potential for calamity increases. At the moment, we are teetering, weighed down on one side by an exclusive objectivity, unbalanced by plural subjectivity.

I have called this thesis *The Eye of the Storm* partly as a reference to the approaching storm of climate change and partly as a metaphor for the balance that humanity must seek. Civilisation will always be buffeted by forces from without and threatened by forces from within. To survive, it must create a calm, stable place that balances out these forces, akin to the eye of a storm. Without such balance, it is entirely possible that humanity will join millions of other species in extinction. With such balance, humanity may continue to carry the spark of intelligent life into the future to discover what it will become.

I am not convinced that climate change is the most serious of the many threats to the human balancing act. Issues of terrorism, conflict and water scarcity all strike me as more threatening at this point of time. However, the human response to climate change has great symbolic importance given the global nature of the problem. An effective response to climate change will require unprecedented global cooperation, supported by the widespread emergence of worldcentric awareness. Thus, an effective response to climate change would truly mark the dawning of a new global age, with new global governance structures and a new structure of consciousness.

Finding balance on a global scale will require wisdom and foresight amongst leaders. It will require protection and creation of diversity to provide a source of solutions and resilience. The balance sought is a harmony that embraces diversity. As Boyle, Thomas and Wield (2000, p.226) put it:

> It would be harmony of the kind found in a great symphony, embracing dissonance and counterpoint, sorrow and joy, but in the context of more profound underlying themes that are ultimately harmonious in the deepest spiritual sense.

I believe that the solutions to the civilisational challenge will be found in the noosphere, in a global meeting of minds, supported by information and communication technologies. They will emerge from the creativity of billions of intricately connected and globally aware people. They will integrate the global and the local, the past and the future, the individual and the collective and the interior and exterior. With luck and foresight we can find a balanced future in the eye of the storm.

Appendix A: The Twenty Tenets

From Wilber (2000a, pp.313-314):

1. Reality as a whole is not composed of things or processes, but of holons.
2. Holons display four fundamental capacities: (a) self-preservation (agency), (b) self-adaptation (communion), (c) self-transcendence (eros), and (d) self-dissolution (thanatos).
3. Holons emerge.
4. Holons emerge holarchically.
5. Each emergent holon transcends but includes its predecessor(s).
6. The lower sets the possibilities of the higher; the higher sets the probabilities of the lower.
7. The number of levels that a hierarchy comprises determines whether it is 'shallow' or 'deep'; and the number of holons on any given level we shall call its 'span'.
8. Each successive level of evolution produces greater depth and less span.

   Addition 1: The greater the depth of a holon, the greater its degree of consciousness.
9. Destroy any holon, and you will destroy all of the holons above it and none of the holons below it.
10. Holarchies coevolve.
11. The micro is in relational exchange with the macro at all levels of its depth.
12. Evolution has directionality:
    a. Increasing complexity.
    b. Increasing differentiation/integration.
    c. Increasing organization/structuration.
    d. Increasing relative autonomy.
    e. Increasing telos.

Addition 2: Every holon issues an IOU to the Kosmos.

Addition 3: All IOUs are redeemed in Emptiness.

Appendix B: Causal Layered Analysis and Integral Theory

B.1 Levels of reality in causal layered analysis

Causal layered analysis 'takes as its starting point the assumption that there are different levels of reality and ways of knowing' (Inayatullah 1998). Inayatullah defines four such levels of relevance to futures work. The first, or shallowest, is the *litany*, which is the official public or media description of an issue in terms of 'quantitative trends…[and] problems, often exaggerated, often used for political purposes' (Inayatullah 1998, p.820). The second level 'is concerned with *social causes*, including economic, cultural, political and historical factors' (Inayatullah 1998, p.820).[76] It provides interpretation of quantitative data, technical explanations and academic analysis. The third level 'is concerned with structure and the *discourse/worldview* that supports and legitimates it' (Inayatullah 1998, p.820).[77] The fourth layer is concerned with *metaphor and myth*, focusing on 'the deep stories, the collective archetypes, the unconscious dimensions of the problem or the paradox' (Inayatullah 1998, p.820).

B.2 An integral interpretation

Inayatullah (2002a) conceives the levels as a holarchy; quantitative data is embedded in a context of meaning, which is itself embedded in an epistemological structure or worldview, which is informed by myths and metaphors. That is, depth increases from the level of the litany, through social causes and worldviews/discourses, to the level of myth and metaphor. From an integral perspective, Inayatullah apparently confuses quadrants, waves and streams. Consider Inayatullah's (1998) first two levels: the litany and social causes. Both tend to focus on quantitative data and problems, but the second level adds interpretation, technical explanations and academic analysis of economic, social, political and historical factors. In integral terms, I would argue that both levels tend to reduce problems to their objective or quantitative components (the behavioural and systemic quadrants) and marginalise important subjective realities. However, the second level provides a more adequate description of these realities, emanating from a later wave of cognitive development. That is, I contend that the first two levels of CLA both focus on the objective quadrants but emanate from different cognitive waves.

Inayatullah's (1998) third level is concerned with structure, discourse and worldview. Inayatullah argues that the third level provides deeper analysis than the first two levels. While this may be true, the more important difference between this level and the first two levels is a shift of perspective from the objective quadrants to the cultural or intersubjective quadrant. Inayatullah moves towards

[76] My italics.
[77] My italics.

an integral perspective by considering the cultural quadrant alongside the objective quadrants. However, by arguing that the level of discourse and worldview is necessarily deeper than the level of social analysis, Inayatullah commits what Wilber calls ‘quadrant absolutism’, favouring cultural explanations over explanations from the other quadrants. This, of course, is typical of poststructural approaches, which emphasise cultural context as the source of reality.[78] While a cultural explanation may indeed emanate from a deeper wave of development, the cultural quadrant is also open to superficial analysis from shallower waves of development.

Inayatullah’s quadrant absolutism continues with the fourth and deepest level of CLA. Again, Inayatullah gives preference to cultural explanations, this time focusing on myth and metaphor. From an integral perspective, discourse, worldview, myth and metaphor can be understood as different developmental streams in the cultural quadrant. Each is an element of a cultural holon evident at all waves of development. In other words, myth and metaphor do not underlie discourse and worldview – they develop alongside discourse and worldview.

Despite these conceptual differences with integral theory, Inayatullah’s emphasis of the cultural quadrant is an important and necessary contribution to futures work. I use CLA as a useful anthropological approach that can reveal discourses, worldviews, myths and metaphors in the cultural quadrant. However, in an integral approach, CLA must be complemented by methods that draw out aspects of the other quadrants. In support of this conclusion, Slaughter (2002d) specifically identifies CLA with the cultural quadrant.

[78] Inayatullah also gives no real attention to the intentional quadrant, as there is no subject in post-structural theories.

Appendix C: The Implications for Australia of a 450-ppmv Stabilisation Target for CO_2

This appendix examines the implications for Australia of the international adoption of a 450 ppmv atmospheric stabilisation target for CO_2. I have assumed that the target would be implemented using a contraction and convergence model, as this model seems most likely to attract future participation by developing nations.

To achieve a CO_2 concentration target of 450 ppmv, global CO_2 emissions would need to fall to between 2 and 5 GtC/yr by 2100 (IPCC 2001b). Byrne et al (1998) demonstrate how to operationalise a contraction and convergence model. Following their method, and using the year 2000 population as a baseline[79], the allowable global per capita CO_2 emission rate in 2100 is between 0.33 and 0.83 tC per person per annum. Australia's allocation of CO_2 emissions in 2100 would therefore be between 6.3 and 15.8 MtC per annum, or 23 to 58 Mt CO_2-e per annum.

Australia's CO_2 emissions in 2000 were 379.9 Mt CO_2-e per annum (AGO 2002b), so Australia would need to reduce its emissions by 85 to 94 per cent by 2100 to comply with a contraction and converegence regime aimed at stabilising CO_2 concentrations at 450 ppmv. Australia's target is substantially higher than the global target because it currently has the highest per-capita GHG emissions of any Annex B countries, at 27.9 t CO_2-e per year (Turton & Hamilton 2002).

However, as Berk and den Elzen (2001) demonstrate, Australia might need to achieve the bulk of these reductions much sooner, depending on the choice of convergence date. As it is the cumulative emissions over the 21st century that contribute to the atmospheric CO_2 concentration, it may be necessary to achieve much of the reduction by 2050. A target of a 60 per cent reduction in emissions by 2050 would seem appropriate and is consistent with targets adopted elsewhere (e.g. UK DTI 2003).

Other participation models would require Australia to achieve reductions of a similar magnitude. Berk and den Elzen's (2001) modelling shows that an 'increasing participation' regime would require similar GHG reductions by 2050, and an even faster rate of reduction through to 2030. Reductions of this magnitude are common to any approach that aims to stabilise the atmospheric concentration of CO_2 at 450 ppmv and that introduces equity by considering per capita emissions. Clearly, the implications for Australia are significant. It is likely that Australia would rely at least partly on international emissions trading to achieve its targets under an international climate policy regime that takes per capita emissions into account.

[79] I have assumed world population of 6 billion in 2000, and Australian population of 19 million in 2000.

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