New Perspectives on Institutional Change: The Case of Changing Energy Management Practices in Australia

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This thesis is presented for the degree of PhD in Management

1 May, 2014

Certificate of Original Authorship

I certify that the work in this thesis has not previously been submitted for a degree, nor has it been submitted as part of the 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.

The research presented in this thesis was approved by the University of Technology, Sydney Human Research Ethics Committee, Approval Number: 2013000126.

Signature of Student:

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List of Acronyms and Abbreviations

AUD	Australian Dollar
Btu	British Thermal Units
CCS	Carbon Capture and Storage
CDP	Carbon Disclosure Project
CO_2	Carbon dioxide
CPRS	Carbon Pollution Reduction Scheme
Department of RET	Australian Government Department of Resources, Energy and Tourism *
Department of Industry	Australian Government Department of Industry *
Department of ITR	Australian Government Department of Industry, Tourism and Resources *
EEBP program	Energy Efficiency Best Practice program
EEO legislation	*Energy Efficiency Opportunities Act 2006* (Cth) Energy Efficiency Opportunities Regulations 2006 (Cth)
ENGO	Environmental non-governmental organisation
EPA	U.S. Environmental Protection Authority
ESCO	Energy service company
ESG	Environmental, social and corporate governance
ETS	Emissions Trading Scheme
$GtCO_2$	Gigatonnes of CO_2
GBCA	Green Building Council of Australia
G8	Group of Eight (of the largest global economies)
IAC	Industrial Assessment Center
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPMVPC	International Performance Measurement & Verification Protocol Committee
ISO	International Organization for Standardization
KPI	Key Performance Indicator

NABERS	National Australian Built Environment Rating System
NGER Act	*National Greenhouse and Energy Reporting Act 2007* (Cth)
NGER Scheme	National Greenhouse and Energy Reporting Scheme
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
PJ	Petajoule
Q&A	Question and answer
SCOTS	Social construction of technological systems
SMEs	Small and medium enterprises
USD	United States Dollar
U.S. DOE	United States Department of Energy
White Paper	Australian Government White Paper – *Securing Australia's Energy Future*

*Refer to the glossary for an explanation of the historical name changes associated with these Australian government departments

Abstract

This thesis provides new perspectives on the dynamics of institutional change by examining the case of changing energy management practices in large energy consuming organisations in Australia between 2006–2012. Effective energy management practices can deliver cost savings, greenhouse gas reductions and a range of benefits to organisations and society more widely through energy efficiency improvements. However, there is evidence to suggest that there is a gap between the availability of profitable energy efficiency projects in organisations and the extent to which such projects are implemented. Researchers refer to this phenomenon as 'the energy efficiency gap'.

The thesis builds on contemporary developments in the institutional entrepreneurship literature by developing a multi-level model to conduct the research. Due to the complexity of interrelated issues and events, case study method is applied to analyse and report on the dynamics of changing energy management practices over the study period. The primary research question is: *How* and *why* do energy management practices change?

The research finds that energy management practices evolved over the study period through a process of 'collaborative co-creation'; that is, multiple organisations were involved in experimentation, negotiation and consensus-building processes. These disrupted previously established energy management practices and informed the development and maintenance of new and more effective practices. The thesis contributes to the institutional theory literature by offering original and empirically tested insights into the conditions that support institutional change as a dynamic process involving interactions between multiple organisations. These conditions are that stakeholders with varying degrees of attachment to established management practices are engaged in the change process, roles emerge for institutional entrepreneurs and collaboration is facilitated through the enactment of constructive social skills. Change is further reinforced through shifts in the underlying beliefs about the energy management practices that are considered to be legitimate within a

community of corporate energy practitioners.

Based on the findings, it is concluded that energy efficiency policymakers can encourage the adoption of more effective energy management practices in organisations by developing and refining policies based on three key principles. First, energy efficiency policies should encourage a wide range of organisational stakeholders to engage in the process of energy efficiency improvement. Second, policies should be enduring in order to support learning and institutional change across business cycles. Third, policies should be flexible in order to align with the capability, needs and readiness of organisations in order to accelerate energy efficiency improvement.

1. Introduction

> *"Institutions are the humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions and codes of conduct), and formal rules (constitutions, laws and property rights)."*
>
> *Institutions (North 1991, p. 97)*

This thesis contributes new perspectives on institutional change. It examines how and why energy management practices changed in large energy consuming organisations in Australia between 2006-2012. To do this it creates a multi-level process model of institutional change that makes links between the emerging stakeholders driving energy efficiency concerns, the changing energy management practices adopted by large energy consuming organisations and the shifts in underlying beliefs that inform the development of energy management practices. There is a particular focus on understanding the role that individuals play in the process of change. This chapter introduces the thesis by describing the aim, research questions, approach and contributions of the research. It concludes with an outline of the thesis.

1.1 Aim and research questions

Improving the energy efficiency performance of organisations can reduce business operating costs and cut greenhouse gas emissions significantly in the short-term and deliver many other societal and organisational-level benefits (Ates & Durakbasa 2012; Jollands et al. 2010; Thollander & Ottosson 2010). Despite the potential benefits that are available to organisations and the wider community, cost-effective opportunities to improve energy efficiency in organisations remain underexploited (Bernstein et al. 2007; IEA 2013; Levine et al. 2007). To understand this phenomenon, researchers have typically examined the barriers that limit the uptake of energy efficiency in organisations (Sorrell, Mallett & Nye 2011; Trianni et al. 2013). Few studies examine the way in which organisations develop and adopt effective energy management practices over time (Ates & Durakbasa 2012;

Thollander & Ottosson 2010).

Studies that have examined the adoption of energy management practices in organisations (e.g.Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006; Thollander & Ottosson 2010) examine energy management practices as a static phenomenon. That is, these studies focus on the extent to which particular energy management practices have been adopted at a particular point in time, but do not provide insights into the dynamic[1] process by which established energy management practices are disrupted and new practices are developed and then maintained by organisations. Further, there has been limited examination of the influence that stakeholders within and external to organisations have on energy management practices.

To address these knowledge gaps the primary research question examined in this thesis is: *How* and *why* do energy management practices change in large energy consuming organisations?

This question is supported by three secondary research questions that aim to expose the dynamics of institutional change:

1. How do corporate personnel with responsibility for energy efficiency improvement (referred to as 'corporate energy practitioners' in this thesis) influence the disruption, development and maintenance of energy management practices?
2. Who are the other key stakeholders that influence energy management practices and how do they affect change?
3. How does the organisational and organisational field-level context influence individual decision-making on energy efficiency projects?

These questions are developed further in Section 5.1 of this thesis.

[1] In this thesis the term 'dynamic' refers to the process through which stakeholders interact to influence energy management practices.

The theoretical aim of this thesis is to contribute new perspectives on the dynamics of institutional change by examining the case of changing energy management practices in large energy consuming organisations in Australia. In terms of practice, the aim is to provide insights into the actions that policymakers and other stakeholders can take to accelerate the adoption of effective energy management practices by organisations.

1.2 Approach and contributions of the research

To achieve these aims, this thesis draws on and extends contemporary interpretations of institutional theory. Specifically, a multi-level model of institutional change is developed to examine changing energy efficiency practices in Australian organisations over the period 2006–2012. The research focuses on large energy consuming organisations[2] and examines energy efficiency in their existing facilities. The model of institutional change that is developed and applied empirically examines how corporate energy practitioners exploit the expanding interest of stakeholders[3] to overcome hierarchical, professional and structural boundaries within their own organisations. This enables organisations to accelerate energy efficiency improvement through the development of new and more effective energy management practices.

The research also highlights how practitioners disrupt and re-establish 'taken-for-granted' energy management practices by selectively applying strategies that aim to influence the cognitive, normative and regulative institutional mechanisms that have previously served to maintain less effective energy management practices. The processes that support learning and collaboration within and between organisations are also exposed, providing novel insights into the manner in which effective energy management practices are shared and reproduced across organisational boundaries.

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[2] 'Large energy consuming organisations are defined as organisations using more than 0.5PJ of energy annually. As described later in the thesis this definition aligns with the definition applied in the *Energy Efficiency Opportunities Act 2006* (Cth)

[3] The term 'stakeholder' is used interchangeably with the term 'actor' in this thesis. It refers to any individual, group or organisation who can affect or who are affected by the activities of a single organisation or a community of organisations. This definition is based on Freeman (1984, p. 46).

The research makes important contributions to the institutional entrepreneurship and energy efficiency literatures. The notion of institutional entrepreneurship is that: “new institutions arise when organized actors with sufficient resources (institutional entrepreneurs) see in them an opportunity to realize interests that they value highly” (DiMaggio 1988, p. 14). However, since the notion of institutional entrepreneurship was first introduced by DiMaggio (1988), institutional researchers have been challenged to explain the way in which actors change institutions when actors are themselves subject to institutional pressures – the so-called ‘paradox of embedded agency’ (Dorado 2005; Holm 1995; Seo & Creed 2002).

Institutional theorists have been critical of the way in which stakeholders have been depicted as socially determined ‘cultural dopes’ that are deeply embedded in and influenced by social forces (at one extreme) or as heroic actors able to overcome social pressure with relative ease (at the other extreme) (Fligstein 2001; Powell & Colyvas 2008; Suddaby 2010b). This has led to calls for institutional researchers to develop more comprehensive depictions of institutional entrepreneurship and change by examining human agency as a distributed phenomenon that involves interactions between multiple stakeholders (Battilana, Leca & Boxenbaum 2009; Lounsbury & Crumley 2007). By examining the interactions between multiple stakeholders in an organisational field over time, under theorised aspects of institutional change are developed in this thesis. Specifically, this thesis contributes to the institutional entrepreneurship and institutional theory literatures by:

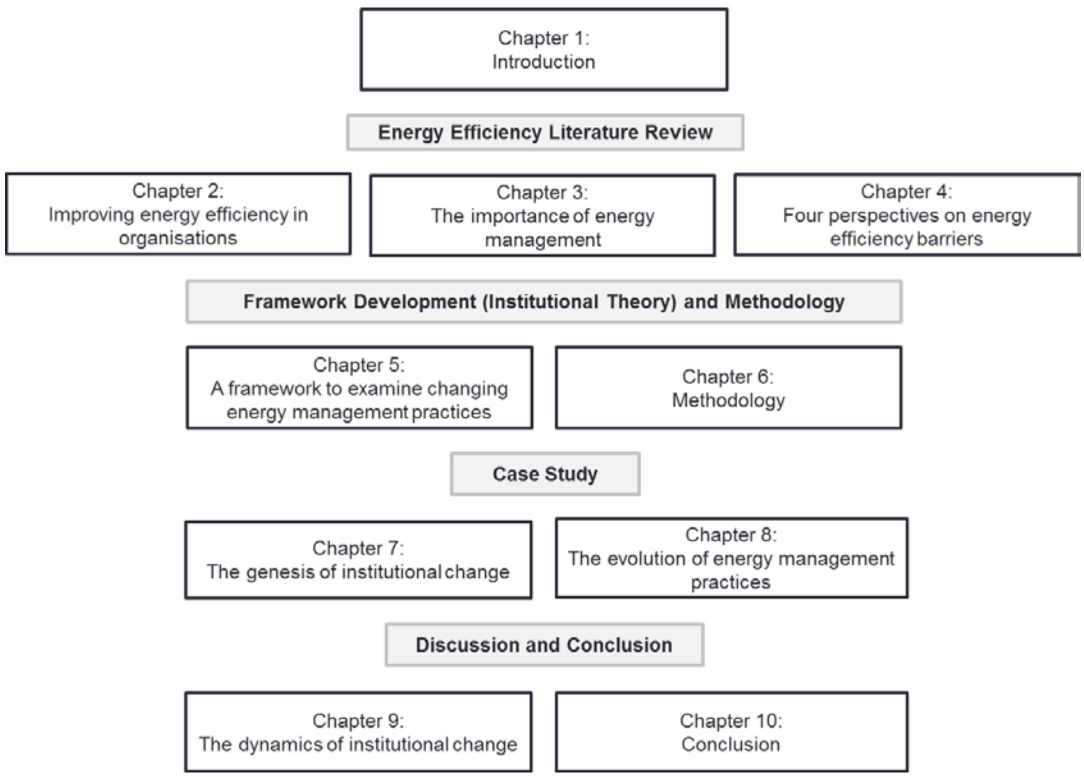
- revealing the social conditions that support institutional change as a collaborative process (involving multiple stakeholders in experimentation, negotiation and consensus-building processes)
- highlighting how and why the involvement of stakeholders with varying degrees of social embeddedness (i.e. “the degree to which actors and their actions are linked to their social context” (Reay, Golden-Biddle & Germann 2006, p. 978)) are engaged in and contribute to institutional change, and
- identifying the role key social skills that stakeholders actively involved in progressing institutional change apply to successfully progress institutional change in complex social environments.

The application of recent understandings in institutional theory to the problem of 'the energy efficiency gap' provides scholars and policymakers with new perspectives on the reasons for the gap and the actions that can be taken to accelerate the adoption of effective energy management practices in organisations to resolve it. The processes associated with identifying, evaluating and implementing energy efficiency projects within organisations are complex (Biggart & Lutzenhiser 2007; Palm & Thollander 2010; Warren-Myers 2012). By considering the way in which multiple stakeholders influence practices over time at the project, organisational and interorganisational levels, a more comprehensive view of the factors that both create and address barriers to energy efficiency in organisations is developed. This comprehensive perspective has important implications as organisations, governments, investors and other stakeholders consider the strategies they can apply to accelerate the adoption of effective energy management practices in organisations.

1.3 Outline of the thesis

The structure of the thesis is shown in Figure 1.1. A detailed description of each chapter follows.

Figure 1.1: Structure of the thesis



Chapter 1: *Introduction.* As explained earlier, this chapter introduces the thesis and describes the aim, research questions, approach, contributions of the research and provides an outline of the thesis.

Chapter 2: *Improving energy efficiency in organisations* establishes the important contribution that energy efficiency improvement in organisations can make towards reducing greenhouse gas emissions in the short-term and delivering a range of other environmental, social and economic benefits to organisations and society.

Chapter 3: *The importance of energy management* reviews the existing academic literature on energy management practices and government energy efficiency policy. First, key terms are defined, including 'energy management', 'energy management systems' and 'energy management practices'. Second, the review identifies that – while there has been empirical work examining the adoption of energy management practices in particular industries – there is a need for research that examines how effective energy management practices are developed, adopted and maintained by organisations. The primary research question: *How* and *why* do energy management practices change? – emerges from this review of the literature. Chapter 3 concludes by highlighting the need to examine the underpinning theoretical assumptions that have been applied within the energy efficiency literature.

Chapter 4: *Four perspectives on energy efficiency barriers* reviews the extensive literature examining the energy efficiency gap in organisations in order to inform the formulation of an appropriate theoretical approach for this research. The review is structured according to four broad perspectives:

1. a neoclassical economic perspective
2. a behavioural perspective
3. an organisational-level perspective, and
4. an interorganisational perspective.

The review highlights the need for research that extends the interorganisational perspective and incorporates multi-level research design.

Chapter 5: *A framework to examine changing energy management practices* establishes the theoretical framework for the study. It is argued that institutional theory is particularly suited to examining change at the level of the organisational field. At the same time it can effectively accommodate multi-level analysis from the micro level (e.g. energy efficiency projects), meso level (e.g. organisations) and macro level (e.g. the organisational field). Contemporary developments in institutional theory (particularly those associated with institutional entrepreneurship and collective action models of institutional change) are reviewed and used in the development of the empirical model of institutional change.

Chapter 6: *Methodology* describes the methodology applied in the empirical research. It justifies the relevance of developing a critical and revelatory case study of changing energy management practices in Australian organisations between the years 2006–2012. The chapter outlines the methodological assumptions, scope of the case study, sources of data and the analytic process that was followed.

In Chapter 7: *The genesis of institutional change*, the background to the case study, including development of the *Energy Efficiency Opportunities Act 2006* (Cth),[4] is presented. The institutionalised energy management practices that were applied by large energy consuming organisations as they first began to respond to their obligations under the EEO legislation are then described. Finally, changes in the stakeholder composition of the organisational field associated with energy management practices over the study period are examined.

Chapter 8: *The evolution of energy management practices* presents the changes to energy management practices that occurred over the study period in four thematic areas emerging from the analysis:

1. engaging staff in energy management
2. developing energy information systems
3. identifying potential projects, and
4. integrating energy management into existing management systems.

[4] The *Energy Efficiency Opportunities Act 2006* (Cth) and Energy Efficiency Opportunities Regulations 2006 (Cth) are referred to as the 'EEO legislation' throughout this thesis.

Within each of the thematic areas new practices are described. The analysis particularly focuses on the dynamic process of institutional change that influenced the development of these energy management practices.

Chapter 9: *The dynamics of institutional change* discusses the implications of the research. First, the dynamics of changing energy management practices are summarised within and across each level of analysis. Second, the implications for institutional theory are discussed. Third (and finally), the implications of the research for policymakers and other stakeholders concerned with accelerating the adoption of effective energy management practices are presented. The chapter concludes by discussing the limitations of this research and makes recommendations for future research.

Finally Chapter 10: *Conclusion,* briefly summarises and concludes the thesis.

2. Improving energy efficiency in organisations

2.1 Introduction

The aim of this chapter is to evaluate the importance of energy efficiency improvement in organisations and to introduce the notion of the 'energy efficiency gap' (i.e. the gap between actual and optimal energy use in organisations). This chapter will begin by describing the urgent energy supply transition that is currently underway. This transition, driven by the rising concentration of greenhouse gas emissions in the atmosphere, involves a shift away from society's reliance on fossil fuels and a shift towards the development of low carbon energy systems. The multiple benefits that accrue from improved energy efficiency (i.e. using less energy to deliver more goods and services) are then examined. This highlights the significant potential that improved energy efficiency performance in organisations can deliver to organisations and society more broadly. Finally, the notion of the energy efficiency gap (defined above) is introduced. The chapter establishes the wider environmental, social and economic context within which this thesis research is conducted.

2.2 The transition to a low carbon energy system

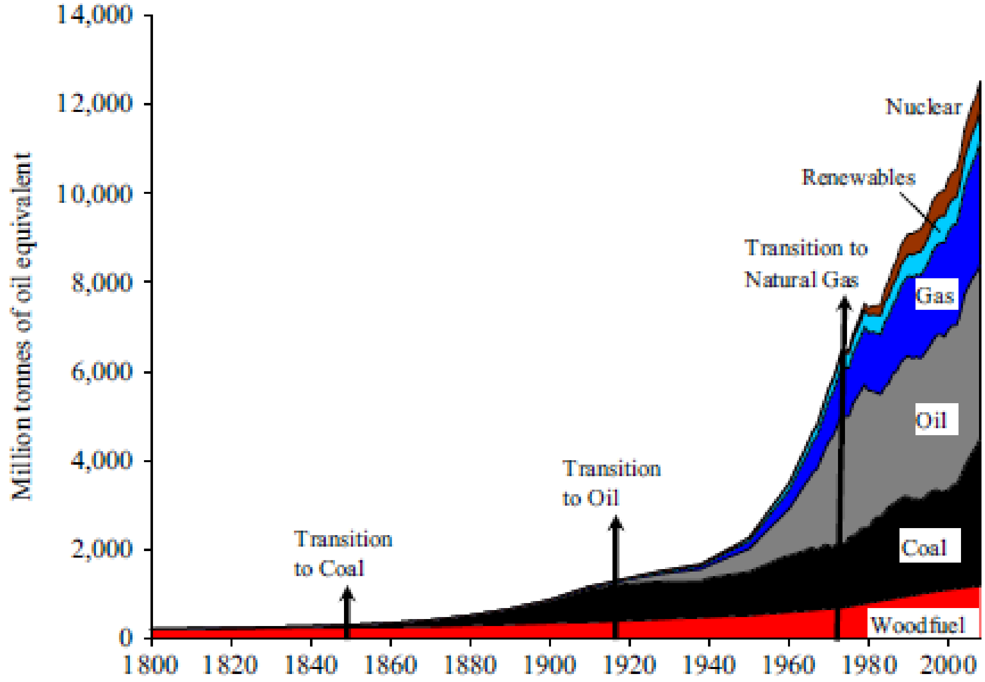
> *"Climate change is a defining challenge of our time ... The energy sector is by far the largest source of greenhouse-gas emissions, accounting for more than two-thirds of the [global] total in 2010 ... Energy has a crucial role to play in tackling climate change. Yet global energy consumption continues to increase, led by fossil fuels, which account for over 80% of global energy consumed, a share that has been increasing gradually since the mid-1990s."*
>
> *Redrawing the Energy-Climate Map*
> *The International Energy Agency (2013, p. 16)*

Energy is vital to advance living standards and create wealth. The ability of societies to meet the energy needs of growing populations and economies plays a central role in contributing towards human wellbeing. (Allen 2009; Fouquet 2011, p. 906; Rühl et al. 2012). The relative prosperity and power of nations can, in part, be related to the availability and use of energy (Lutzenhiser 1993; Shove et al. 1998). Since the industrial revolution, there have been a number of energy transitions; that is, changes in the sources of energy that an economic system is dependent on (Fouquet & Pearson 2012). For example, the total proportion of energy used globally has shifted from wood fuel to coal and then to oil and to gas (Fouquet 2009). Within these broader energy transitions, energy constraints have also caused short-term periods of disruption. A prominent example is the oil crisis in the 1970s that had a significant impact on the global economy and limited global economic growth for over a decade (Hamilton 2011).

Currently a significant energy transition is underway. This involves a movement away from a reliance on greenhouse intensive fossil fuels (e.g. coal, oil and gas) to cleaner, renewable sources of energy and towards more efficient use of energy. As Figure 2.1 highlights, this transition began relatively recently. In 2010, fossil fuels still accounted for 86% of global primary energy use (IEA 2011).

Figure 2.1: Global energy consumption and transitions 1800–2010

(Source: Fouquet 2009, p. 49)



The need to reduce reliance on fossil fuel-based energy supplies (due to the significant environmental, social and economic impacts of these energy sources) has driven the current transition. Impacts range from local pollution issues, such as the emission of poisonous sulfur dioxide gas that is associated with burning coal, to global climate change (Allen 2009; Fouquet 2011). Another important driver for change is the acknowledgement that fossil fuels are a finite resource. Supply is reliant on discovery of new sources and ultimately, fossil fuels may be prohibitively expensive to access or they may even become depleted (Campbell 2012). The use of fossil fuels may also be constrained by the need for global action to minimise global warming. To keep global warming below two degrees Celsius it has been estimated that only 20% of available fossil fuels should be burnt before 2050 (Leaton et al. 2013)

There are many factors that constrain the pace of the current energy transition. For example, not incorporating externalities such as social and environmental costs into the price of fossil fuels means that prices do not reflect the true cost of these fuels. This encourages ongoing use of fossil fuels rather than alternatives (IMF 2013;

National Research Council 2010). The relationship between economic growth, energy security and poverty eradication is another of the many significant challenges associated with the current energy transition. Where fossil fuels are the cheapest energy source in underdeveloped nations, then attempts to limit access to these sources may create a trade-off that affects fundamental social issues, such as poverty eradication (Bhattacharyya 2010).

Historically, energy transitions have occurred over long periods of between 40–120 years (Allen 2012; Fouquet & Pearson 2012). Unique to the current transition is that climate change scientists highlight the need for large-scale greenhouse gas mitigation to occur in the short-term through decarbonisation of the global energy system and other means such as carbon sequestration through forests (Pearson & Foxon 2012). Scientists have suggested that for the global climate to remain relatively stable, the concentration of greenhouse gas emissions needs to be maintained below 450 parts per million of carbon dioxide equivalent emissions. Scientists suggest that it is necessary to maintain average global temperature increases below two degrees Celsius in order to minimise the impacts of climate change (IPCC 2007). Economic research by Sir Nicholas Stern (2007) in the United Kingdom and Professor Ross Garnaut (2008) in Australia has demonstrated that the benefits of early action on climate change significantly outweigh the costs that are likely to be incurred in the longer term.[5]

Ultimately, the transition to a low carbon energy system requires the development and deployment of renewable energy generation technologies, such as wind and solar. However, due to the costs associated with these technologies and the advantages provided to fossil fuels through financial subsidies, decarbonising energy supplies rely heavily on government support. Supply-oriented government programs have had varied success in accelerating investment in and use of renewable energy sources (Carley 2009; Delmas & Montes-Sancho 2011; Verbruggen et al. 2010). Assuming that strong government support is made available globally, renewable energy sources are projected to progressively increase their share of global electricity

[5] Some economists have contested these studies. For example, discount rates used by Stern in his analysis have been challenged for being too low (Nordhaus 2007).

generation from 19% in 2008 to 33% by 2035. This trajectory for change from fossil fuels to renewable energy will not be sufficiently rapid in its own right to constrain the concentration of greenhouse gas emissions to the extent that they will limit the rise in global temperature below two degrees Celsius (IEA 2011). Due to the costs and lead time required to modify energy supply, demand side measures (i.e. measures that focus on the way energy is used rather than supplied) provide an important solution that can deliver cost-effective greenhouse gas reductions and deliver other significant environmental, social and economic benefits in the short-term. Energy efficiency is one of the most important of the demand management options available to organisations (Dunstan, Ross & Ghiotto 2011).

2.3 The benefits of energy efficiency improvement in organisations

> *"One of the greatest challenges of our time [is determining] how to fuel economic growth while also addressing climate change and the consequences of our dependence on fossil fuels. To meet this challenge head on, the nations of the world will need to rely on a plan full of energy options. ... the simplest, most accessible and cheapest option is increasing energy efficiency and conservation. It is not only the cleanest option; it is also the easiest to implement and the quickest way to extend our energy supplies while also slashing carbon emissions."*
>
> *Andrew Liveris, Chief Executive Officer and Chairman, The Dow Chemical Company, USA (World Economic Forum 2010, p. 34)*

Defining energy efficiency

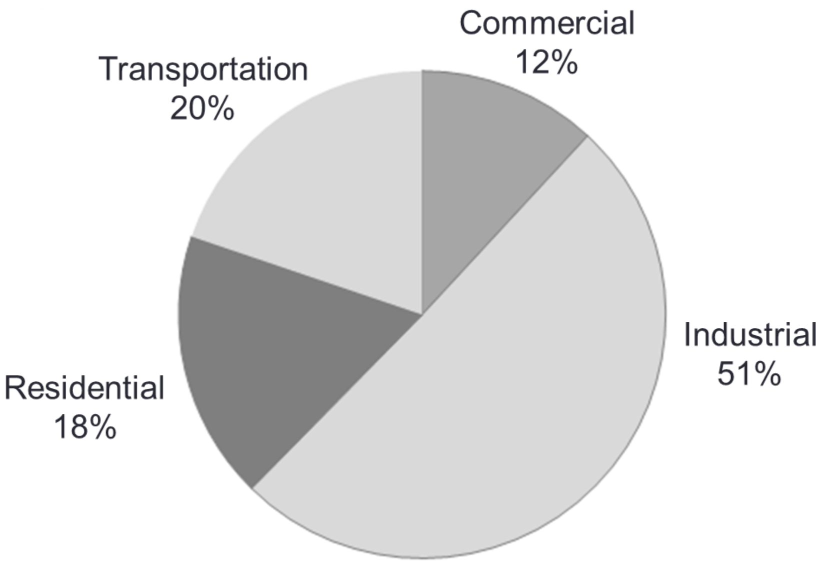
Energy efficiency, the focus of this thesis, refers to using less energy to produce the same amount of energy service or useful output (Jollands et al. 2010; Lovins 2004; Patterson 1996; World Energy Council 2008). Economists consider energy demand to be derived; that is, it is not the *energy* that consumers require, it is the benefits of these services delivered by end-use technology that utilise energy (Aune, Berker & Bye 2009; Croucher 2011b; Mills & Rosenfeld 1996). Energy services (or useful outputs) include heating, cooling, light, mechanical work and transportation (Ayres, Turton & Casten 2007; Nakicenovic 1995). Considered in this way, end user perspectives typically focus on the energy end-use technology and outputs, rather than the energy itself (Aune, Berker & Bye 2009). Therefore, unless outcomes or service requirements are compromised, end users are not disadvantaged when less energy is used to deliver the required outcomes or services.

Energy efficiency measures include changes in end-use technologies. For example, compact fluorescent light bulbs use around 80% less energy than a traditional incandescent and yet they can deliver the same useful light output and illumination (Radulovic, Skok & Kirincic 2010). Changes in behavioural practices are also an important way of improving energy efficiency. For example, encouraging people to turn off lights, equipment and air conditioning in buildings when they are not in use can yield significant energy savings at low or no cost (Masoso & Grobler 2010). Improving operational controls may also support improvements in energy efficiency. For example, an organisation may install light sensors or building automation systems that monitor and turn equipment off automatically (Rohdin & Thollander 2006). Indirectly, initiatives such as improving energy metering and data feedback mechanisms can provide information to support both automated and manual control of energy (Granderson, Piette & Ghatikar 2010).

The benefits and potential associated with improving energy efficiency in organisations

At a global level, significantly more energy is consumed by organisations than households. Figure 2.2 provides a breakdown of the proportion of primary energy use in the industrial, commercial, transportation and residential sectors. The electricity component of energy use has been calculated by accounting for the electricity consumed in each sector and then apportioning electricity losses. Electricity losses occur in the process of electricity generation, transmission, and distribution. Energy is consumed by organisations in the commercial sector (also referred to as the services sector) in many different types of buildings and to supply services such as traffic lights and water and sewer services. The commercial and residential sectors are typically highly electricity dependent which means that there is a greater proportion of energy losses compared to the industrial and transportation sectors which rely more on gas and other primary energy sources. Energy consumption in the industrial sector is diverse and includes activities associated with manufacturing and mining. Energy is consumed in the transportation sector to move goods and people in many different ways including by road, air and pipeline (U.S. Energy Information Administration 2013b). While tt is appropriate to examine the potential for improvement in each of these sectors, in this thesis the focus is on the use of energy by large energy consuming organisations in the industrial, commercial and transportation sectors.

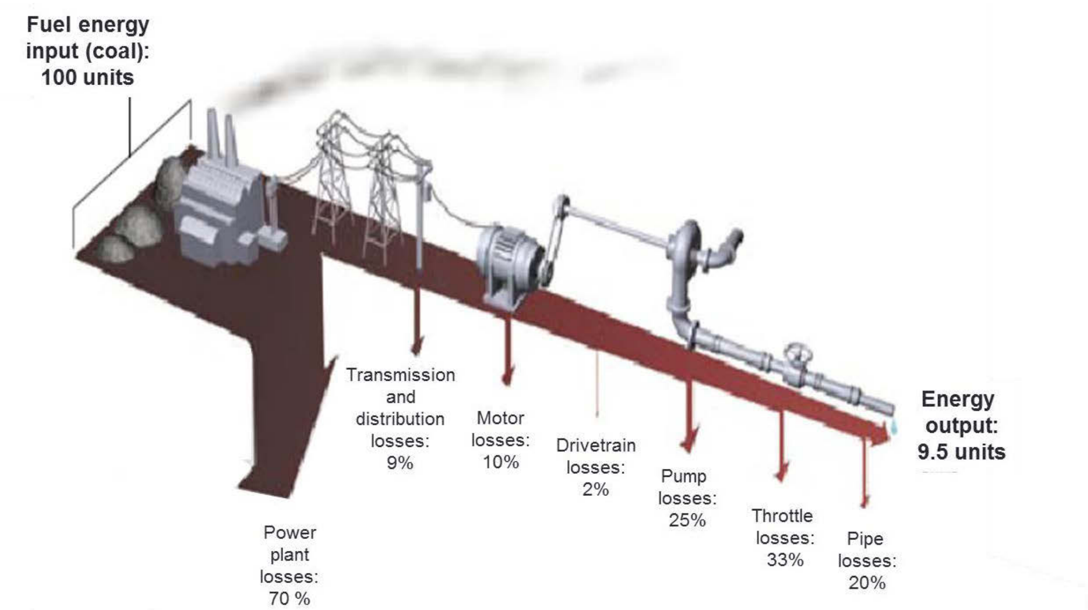
Figure 2.2: Global energy consumption by sector (primary energy)
(Source: Adapted from U.S. Energy Information Administration 2013a)



Numerous studies have attempted to quantify the size and financial potential of improving energy efficiency in organisations. For example, the consulting firm McKinsey & Company found that the implementation of cost-effective energy efficiency projects led to estimates that organisations in the United States could reduce energy demand by 23% to 2020 at an annual net saving of USD680 billion (Brennan 2013; Enkvist, Naucler & Rosander 2007). Participants in the Australian Energy Efficiency Opportunities program have implemented energy savings of 88.8 Petajoules (PJs) between the years 2006–2011. These energy savings represent around 1.5% of Australia's energy use. Businesses will obtain a collective benefit of an estimated AUD800m a year (van Moort et al. 2013). Energy efficiency improvements are also typically associated with improving productivity in firms by increasing output per unit of energy – both through reducing the energy intensity of the operation and improving the productivity of other input factors as well (Aguirre et al. 2011; Boyd & Pang 2000; Kounetas, Mourtos & Tsekouras 2012; Porter & van der Linde 1995). A number of other benefits include other operations and maintenance savings (Larsen et al. 2012), indoor air quality (Vine 2003) and worker productivity (Miller et al. 2009).

Organisations that implement energy efficiency measures are not the only beneficiaries. For example, changes in the end-use of energy deliver benefits throughout the energy supply chain. Figure 2.3 illustrates the energy losses that occur from a power plant burning coal to generate electricity through to the delivery of hot water in an industrial plant. The losses relate to electricity supply and use by the pump.

Figure 2.3: Energy losses across the electricity supply chain
(Source: Lovins 2005, p. 76)



At the economy level, energy efficiency can reduce demand for energy. This subsequently reduces the need for and costs associated with building new infrastructure (Brennan 2010). This benefit has been termed *negawatts* – a play on words highlighting the fact that energy efficiency is essentially the cheapest available *source* of energy (Lovins 1996; Steinberger, van Niel & Bourg 2009). Energy efficiency also contributes to national energy security by reducing demand for energy and the impact of supply disruptions (Jamasb & Pollitt 2008; Rogers-Hayden, Hatton & Lorenzoni 2011; Sovacool & Brown 2010).

The flow-on benefits of reducing the demand for energy infrastructure include a number of ‘hidden costs’ or externalities associated with power generation and transmission. A study by the National Research Council of the National Academies in the United States (National Research Council 2010) identified a range of costs not incorporated into electricity prices. These ‘externalities’ include:

- health effects associated with localised pollution around power stations
- potential impacts of climate change, and
- a range of environmental and social issues associated with the extraction of raw materials, processing and conversion to electricity or fuel, transmission and distribution.

Scott et al. (2008) analysed the macro-economic impact of the U.S. Department of Energy (U.S. DOE) programs targeting improvements in the energy efficiency of United States residential and commercial building stock. The analysis estimated that by the year 2030, these savings have the potential to:

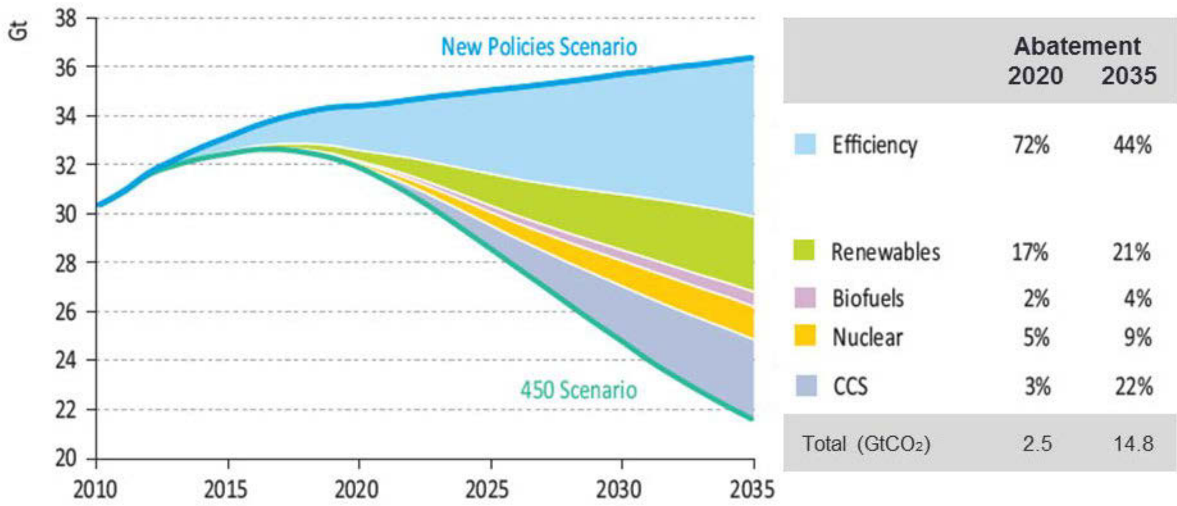
- increase employment by up to 446,000 jobs
- increase wage income by USD7.8b
- reduce the need for capital stock in the energy sector and closely related supporting industries by about USD207b (and the corresponding annual level of investment by USD13b), and
- create net capital savings that are available to grow the nation's future economy.

Modelling undertaken by the International Energy Agency (IEA) suggests that energy efficiency has a key role to play in the transition towards a low carbon energy system (see Figure 2.4). The top line on the graph is the expected trajectory of greenhouse gas emissions under a ‘New Policies Scenario’ (i.e. a situation in which countries implement all existing policies and declared policy intentions). This has been projected to lead to an increase in average temperature of more than 3.5 degrees Celsius. In order to meet the goal of maintaining greenhouse gas emissions (measured as carbon dioxide equivalence CO_2e) concentration in the atmosphere below 450 parts per million, the IEA estimates that energy efficiency has the potential to deliver over 72% of global reductions in energy-related CO_2 emissions in

2020 and 44% by 2035 (IEA 2011). The reason for this is that the technology is already available and much of it is cost-effective.

Figure 2.4: Projected abatement contributions under the 450 parts per million scenario

(Source: IEA 2011, p. 214)



This plethora of diverse benefits combined with the growing urgency to reduce greenhouse gas emissions due to climate change has made energy efficiency a prominent global policy and business issue (World Economic Forum 2010). In 2008, G8 energy ministers stated that: "promotion of energy efficiency in both the energy supply and demand chains in a cost-effective manner is a necessary prerequisite for addressing energy security and climate change while supporting economic growth" (Jollands et al. 2010, p. 6410).

2.4 The challenge of resolving the energy efficiency gap

> *"Despite the vital role that energy efficiency plays in cutting demand … only a small part of its economic potential is exploited… Four-fifths of the potential in the buildings sector and more than half in industry still remain untapped."*
>
> *World Energy Outlook 2012 (IEA 2012, p. 269)*

Despite the many benefits of energy efficiency to businesses (not least of which is the reduction in business operating costs), the evidence that there are many cost-effective energy efficiency projects not being implemented by business is a conundrum that has become known as 'the energy efficiency gap'. This term refers to the gap between the availability of cost-effective energy efficiency projects to firms and the extent to which such projects are implemented (Backlund et al. 2012; Jaffe & Stavins 1994a; Patterson 1996; Sanstad & Howarth 1994). This notion has been presented in a number of different ways (Table 2.1). Underpinning each definition of the energy efficiency gap is an acknowledgement that energy efficiency projects that *appear* to be beneficial to firms and *should* (under usual conditions) be implemented, are not actually being implemented.

Table 2.1: Defining the energy efficiency gap

Author	Definition of the energy efficiency gap
DeCanio (1998, p. 441)	"… the situation where there is abundant evidence that highly profitable energy-saving opportunities exist, yet the technologies embodying these opportunities have not spread universally throughout the economy ..."
Brown (2001, p. 1198)	"… the difference between the actual level of investment in energy efficiency and the higher level that would be cost beneficial from the consumer's (i.e., the individual's or firm's) point of view ..."
Kounetas & Tsekouras (2008, p. 2518)	"… the case in which firms, presumed to behave rationally and to be economically efficient, do not undertake capital investment projects on energy efficiency technologies, although they are preferable in terms of profitability and risk to other non-related to energy efficiency technologies projects …"

In part, the phenomenon of the energy efficiency gap is due to the complexity of energy use in business and society. Consumers use energy to provide a range of different services, such as heating, power, transport and lighting (Fouquet 2010). Services depend on user behaviour in both selecting and using appliances. Some decisions are not available to the consumer as they may be 'designed in' (or not) by equipment suppliers. For example, the decisions made by a water utility can impact on both the cost and environmental impact of the water supply to businesses and households (Crittenden, Benn & Dunphy 2011; Pamminger & Narangala 2009). Within organisations themselves business structures and personal influence by managers may influence the priority placed on energy efficiency improvement (Cebon 1992; Paton 2001). Therefore, many different stakeholders influence the way in which energy is used by a consumer – some of which the consumer can control and others that it cannot control. Unlike energy supply issues which are relatively centralised, decisions about energy efficiency are decentralised, involving multiple decisions at different points in time by a large number of stakeholders (Samouilidis, Berahas & Psarras 1983).

Using the example of a commercial building, energy-related decisions are embedded into the building itself (Ramesh, Prakash & Shukla 2010; Tsai et al. 2011), can be influenced by the purchase and use of equipment by tenants throughout its life (Webber et al. 2006) and may be controlled by the building manager (Aune, Berker & Bye 2009; Costa et al. 2012; Dilling & Farhar 2007; Lewis, Elmualim & Riley 2011; Lindkvist & Elmualim 2010; Yik, Lee & Ng 2002) with the capacity for control being influenced by the information systems incorporated into the building (Lawrence et al. 2012). Of note is that, even as 'greener and more efficient buildings' are designed and being built, such buildings typically require high levels of maintenance and management and there may be a significant disparity between the level of design and the extent to which a building actually performs (Bordass & Leaman 2005; Bordass & Leaman 1997; Leaman & Bordass 2007). The complexity of energy use decisions and actions highlight the point that resolving the energy efficiency gap is complex. The Chapter 3 examines the important role that improved energy management practices in organisations and government policies can play in addressing the energy efficiency gap.

2.5 Conclusion

This chapter has established the environmental, social and economic context within which the research has been undertaken. It highlights the significant role that organisations can play in reducing greenhouse gas emissions and delivering broad societal benefits through the improvement of their energy efficiency performance. However, despite the potential benefits, there is a gap between the availability of cost-effective energy efficiency projects and the extent to which they are implemented by organisations. Building on this important background context, Chapter 3 examines the role that effective energy management practices can play in resolving the energy efficiency gap and the government policies that have been designed to influence energy management practices.

3. The importance of energy management

> *"Systematic energy management is one of the most effective approaches to improve energy efficiency in industries because it equips companies with practices and procedures to continuously make improvements and capture new opportunities."*
>
> *Energy Management Programmes for Industry: Gaining through saving*
>
> *(Reinaud, Goldberg & Rozite 2012, p. 5)*

3.1 Introduction

Chapter 2 examined the need for a rapid transition to a low carbon energy system. It highlighted the critical role that energy efficiency improvement in organisations can play in reducing greenhouse gas emissions and delivering a wide range of economic, social and environmental benefits. The chapter also introduced the notion of the energy efficiency gap. This notion suggests that, despite the potential benefits that energy efficiency can deliver for organisations and society more widely, cost-effective opportunities to improve energy efficiency in organisations remain underexploited.

Chapter 3 presents a review of the existing academic literature on energy management practices and energy efficiency policy to establish key knowledge gaps in the literature that are associated with the adoption of energy management practices in organisations. It begins by providing key definitions before highlighting how energy management practices have been examined in the existing literature. The aim is to highlight what is known about energy management and, in doing so, to identify gaps in the literature that will be addressed in this thesis. The chapter will highlight that there has been limited empirical research that examines the process by which energy management practices are developed and adopted in organisations over time.

3.2 Key definitions

There is no single consistent definition of energy management that is applied in the literature (Backlund et al. 2012) and there are a number of related terms that are used interchangeably (Thollander & Ottosson 2010). This section of the thesis examines the definitional issues associated with three key terms used in this thesis:

1. energy management
2. energy management systems, and
3. energy management practices.

In doing so, this section establishes the rationale that informs the definitions used in this thesis.

Energy management

According to Kannan (2003, p. 946), energy management is: "the judicious and effective use of energy to maximise profits and to enhance competitive positions through organisational measures and optimisation of energy efficiency in the process". This definition highlights a number of important characteristics associated with energy management.

First, energy efficiency is not a core business objective in its own right. Rather, it contributes to broader organisational goals, such as profitability and competitiveness. From this point of view, and in order to understand the effectiveness of energy management, it is necessary to understand an organisation's broader business objectives.

Second, energy management involves: "organisational measures and optimisation of energy efficiency in the process" (2003, p. 946). The inference here is that managers and personnel can influence the amount of energy used to deliver the business outcomes that they seek. Whilst this may appear to be an obvious statement, there is evidence to suggest that many organisations may perceive energy to be a fixed cost item that they cannot influence. Where managers have this belief (or they are in situations where this is the case), they are unlikely to be motivated to attempt improvements in energy efficiency performance (Greening, Greene & Difiglio 2000).

The literature highlights a number of other characteristics that researchers commonly attribute to energy management. First, energy management is an enduring and ongoing process of improvement in energy use rather than an occasional, episodic activity. Cycles of review, feedback and improvement are, therefore, an integral component of effective energy management (Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006; Jelic et al. 2010; Kannan & Boie 2003). Second, energy management is typically considered to be a multidisciplinary activity incorporating skills covering both technical and general management activities (Kannan & Boie 2003). Third, energy management involves a systematic rather than ad hoc approach to energy efficiency improvement. For example, Jelic et al. (2010, p. 613) describe energy management as reflecting a set of activities that are conducted in an "organised, structured, systematic and permanent way".

Energy management systems

According to the ISO 50001 International Standard for energy management (ISO 2011, p. 2) an energy management system is a: "set of interrelated or interacting elements to establish an energy policy and energy objectives and processes and procedures to achieve those objectives". The purpose of an energy management system is to "enable an organisation to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy use and consumption" (ISO 2011, p. 2).

The term 'energy management system' is often used interchangeably with the term 'energy management' (Rohdin, Thollander & Solding 2007). Thollander (2008) suggests that one way of distinguishing between the two terms is to consider an energy management system as a tool that can be used to achieve the goals of energy management. This perspective is also reflected by Reinaud, Goldberg & Rozite (2012, p. 10) who define energy management systems as: "a means by which organisations establish the systems and processes necessary to achieve operational control and continual improvement of energy performance."

As described in ISO 50001, the key components of an energy management system are:

- management responsibility
- energy policy
- energy planning
- implementation and operation
- checking, and
- management review.

Table 3.1 lists these components and their associated sub-components. The table illustrates the range of activities that are associated with the implementation of energy management systems.

Table 3.1: Energy management system requirements in ISO 50001

Requirement	**Sub-requirement**
Management responsibility	None
Energy policy	None
Energy planning	Legal requirements and other requirements Energy review Energy baseline Energy performance indicators Energy objectives, energy targets and energy management action plans
Implementation and operation	Competence, training and awareness Communication Documentation Operational control Design Procurement of energy services, products, equipment and energy
Checking	Monitoring, measurement and analysis Evaluation of compliance with legal requirements and other requirements Internal audit of the energy management system Nonconformities, correction, corrective action and preventative action Control of records
Management review	Input to management review Output from management review

(Source: ISO 2011)

It is important to note that, in some instances, the term 'energy management system' also takes on quite a markedly different meaning to the one discussed here. For example, the International Performance Measurement & Verification Protocol Committee (IPMVPC) defines an energy management system as: "a computer that can be programmed to control and/or monitor the operations of energy consuming equipment in a facility" (IPMVPC 2002, p. 49). This thesis does not use the IPMVPC definition.

Energy management practices

The practices enacted to support the goals of optimising energy use underpin the implementation of energy management and energy management systems. This thesis assumes that groups of people (rather than individuals) influence and 'own' energy management practices. Charles Taylor (1971, p. 27) explains:

> "The meanings and norms implicit in practices are not just in the minds of the actors but are out there in the practices themselves, practices which cannot be conceived as a set of individual actions, but which are essentially modes of social relation, of mutual action."

Consistent with this approach, Zietsma and Lawrence (2010, p. 192) describe practices as: "shared routines or recognized forms of activity". Reckwitz (2002, p. 249) suggests that it is through successive performances of these practices that interdependencies are reinforced between: "forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge".

The following definition of energy management practices is applied in this thesis.

> "Energy management practices are activities recognised by a community as the legitimate means of coordinating around energy use in accordance with the goals of an organisation."

There are three important dimensions associated with this definition.

First, the definition suggests that in order to define energy management practices it is necessary to define the community or groups of individuals and organisations that recognise a set of activities.[6] Within the energy efficiency literature, groups are typically categorised by industry sector, country and/or size of organisation. For example, there is a distinction made in the energy efficiency literature between Small and Medium Enterprises (SMEs) (Cagno & Trianni 2013; Fleiter, Schleich & Ravivanpong 2012; Trianni & Cagno 2012) and large energy consuming or energy intensive organisations (Thollander & Ottosson 2010; Trianni et al. 2013).

Second, this definition suggests that energy performance can only be assessed relative to an organisation's broader goals. Therefore, in considering the appropriateness of particular energy management activities, an organisation's goals must be articulated.

Third, energy management practices are dynamic rather than static; that is, they are constantly evolving. Jelic et al. (2010, p. 613) highlight the dynamic nature of changing energy management practices in the following quote:

> "Until recent times, energy management practices primarily consisted in replacing inefficient equipment and then using any number of methods to estimate obtained savings."

Swords also highlights the evolutionary nature of energy management (2008, p. 61)

> "Energy management has evolved from a practice that focused solely on efficient technology to a multidisciplinary combination of the skills of engineering, management and housekeeping."

Summary

This review of key definitions highlights the importance of research that examines energy management practices with reference to the community of stakeholders that have an interest in such practices as well as the goals of the organisations within which such practices are being applied. Further, energy management and its associated practices should be viewed as a dynamic process of change over time

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[6] This approach may be characterised as a social constructivist ontology which maintains that knowledge is constructed through people's interpretations of reality. This is discussed further in Section 6.2.1.

rather than a static set of pre-defined activities. These definitional insights will be further reinforced in subsequent chapters as existing literature is reviewed and as it is argued that institutional theory is an appropriate theoretical framework for this thesis. The next section examines the treatment of energy management practices in the existing literature. It reviews the energy efficiency literature as well as related work in corporate sustainability and organisational change.

3.3 Energy management practices in the existing literature

The aim of this section is to highlight the wide scope of practices presented in the energy efficiency and related literatures. A large body of practitioner literature exists that examines a range of energy management practices. This review focuses primarily on scholarly articles and publications. The corporate sustainability and organisational change literatures are examined as these are relevant to energy management and whilst this literature is not reviewed in detail it shows that there is little evidence of integration across the literatures. The section concludes by arguing that empirical research into energy management practices can also contribute to the corporate sustainability and organisational change literatures. This perspective will support the efforts to develop an interdisciplinary model in Chapter 5.

Key practices

Table 3.2 lists the key energy management practices that are described in the energy efficiency literature.

Table 3.2: Energy management practices promoted in the existing literature

Energy management practices	References
Develop top management support.	Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006; Thollander et al. 2013; Thollander & Ottosson 2010.
Develop and implement a long-term energy strategy that incorporates energy policy, goals and targets.	McKane et al. 2008; Rohdin, Thollander & Solding 2007; Thollander et al. 2013; Thollander & Ottosson 2007; Thollander & Ottosson 2010.
Appropriately resource and allocate responsibilities for energy efficiency, including through a dedicated energy management system.	Abdelaziz, Saidur & Mekhilef 2011; Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006.
Inform staff of the importance of improving energy efficiency and involve them in the improvement process.	Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006; Goldstein, McKane & Desai 2011.
Conduct an energy audit, assessment or review[7] to identify energy efficiency measures.	Abdelaziz, Saidur & Mekhilef 2011; Anderson & Newell 2004; Kong et al. 2012; Schleich 2004a; Shen, Price & Lu 2012; Thollander et al. 2013.
Integrate energy into cost accounting and budgeting systems.	Ates & Durakbasa 2012; Giacone, Mancò & Gabriele 2008; Granderson, Piette & Ghatikar 2010; Sandberg 2003; Swords, Colyle & Norton 2008; Thollander & Ottosson 2010.

[7] The terms 'energy audit' and 'energy efficiency assessment' are used interchangeably throughout this thesis.

Energy management practices	References
Establish appropriate financial criteria for energy efficiency projects.	Sandberg 2003; Thollander & Ottosson 2010; Trianni et al. 2013.
Develop, maintain and analyse energy-use data through an appropriate metering and monitoring system. Allocate costs to users.	Ferreira et al. 2008; Ke et al. 2013; Swords, Colyle & Norton 2008; Thollander & Ottosson 2010; Trianni et al. 2013.
Systematically incorporate energy-efficiency into procurement processes.	Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006.
Implement energy efficiency projects.	Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006.

This listing of energy management practices illustrates that energy management is a multidisciplinary activity involving technical practices (e.g. energy analysis) and practices more closely related to tasks associated with management (e.g. planning) (Christoffersen, Larsen & Togeby 2006; Kannan & Boie 2003). Another broad category of practice relates to informing and engaging staff in the process of energy efficiency improvement (Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006; Goldstein, McKane & Desai 2011). It is important to note that these practices are not exclusive to the domain of energy or environmental management (Corbett & Kirsch 2001; Viadiu, Fa & Saizarbitoria 2006). As Christoffersen, Larsen and Togeby (Christoffersen, Larsen & Togeby 2006) observe, energy management practices are similar to other management approaches, such as environmental management, health and safety management, and quality and production management. In part, this is due to multi-stakeholder efforts to standardise energy management practices.

For example, the ISO 50001 International Standard for energy management has been intentionally developed in a format that incorporates similar practices to those which exist in quality standards such as the ISO 9000 family of standards – Quality Management and the ISO 14000 family of standards – Environmental Management. One reason why this development approach has been taken is because it will be familiar to organisations that already have these other ISO-type management systems. Aligning energy management practices with practices in other areas can facilitate acceptance and to encourage widespread adoption (Goldstein, McKane & Desai 2011; McKane et al. 2008; Perkmann & Spicer 2008; Viadiu, Fa & Saizarbitoria 2006). Ultimately, the foundation for quality systems can be traced back to scholars such as W. Edward Deming and his work on quality management and the introduction of structured tools such as the Plan-Do-Check-Act cycle (Zbaracki 1998).

Goldstein, McKane and Desai (2011) suggest that a key point of difference between the practices promoted in the ISO 50001 International Standard for energy management and other ISO standards is the strong emphasis on a data-driven approach. The focus on data and statistical approaches is also a feature of other operational improvement tools and practices such as Six Sigma, Lean and Cleaner Production (Besseris 2010; Brady & Allen 2006; Stone 2006). This suggests that there may be useful alignment between the introduction of systematic approaches to energy management and operational tools and management practices that are already being applied within organisations.

The next section briefly examines the corporate sustainability and organisational change literatures. It highlights the benefit of improving the linkages between these literatures and the energy efficiency literature.

Perspectives from the corporate sustainability literature

The corporate sustainability literature also includes descriptions of management practices that are appropriate to energy management. For example, Dunphy, Benn and Griffiths (2007) outline six phases that organisations may follow as they progress from a state of 'rejection' of corporate sustainability towards a sixth and final phase of 'ideological commitment' to corporate sustainability. These phases are:

1. Rejection of corporate sustainability
2. Non-responsiveness
3. Compliance
4. Efficiency

5. Strategic proactivity
6. Ideological commitment

Of note is that efficiency is presented as a middle phase in which organisations recognise the benefits of corporate sustainability in reducing costs and therefore improve resource efficiency. However, it is broadly assumed that cost reduction is, in its own right, a sufficient driver for efficiency and that efficiency is 'largely achieved' before an organisation moves on to strategic proactivity (the fifth phase) or ideological commitment (the sixth phase). The relationship between organisational attitudes towards corporate sustainability in the latter phases and the extent to which this influences energy efficiency performance is unclear and is an issue that will be examined in this thesis.

Dunphy, Benn and Griffiths (2007) propose several management practices that support organisations in moving *between* stages, such as from 'compliance/risk reduction' (the third phase) to 'efficiency' (the fourth phase). These, include:

- educating managers
- creating senior roles to drive change
- conducting audits, and
- developing the business case for efficiency and corporate sustainability to engage senior management.

These types of practices appear to be described consistently across the corporate sustainability and organisational change literature in general.

Other corporate sustainability frameworks also encourage the integration of technical approaches with organisational change-related practices to some extent. Examples include:

- The Natural Step model (Robèrt et al. 2002)
- Whole System Design (Stasinopoulos et al. 2009)
- Natural Capitalism (Hawken, Lovins & Lovins 1999), and
- Factor 4 (Weizsäcker et al. 2009).

Of note is that empirical work in the organisational change for corporate sustainability literature is limited. Considering the similarities across this literature with the energy efficiency literature, the review highlights that empirical research conducted in this thesis will have relevance to the corporate sustainability literature.

Perspectives on organisational change

Over the past 30 years, an extensive body of organisational change literature has developed (Armenakis & Harris 2009). Despite the prevalence of this literature, organisational change programs are widely reported as having a poor success rate (Balogun & Hailey 2004).

Two broad approaches to change in the literature include the:

1. planned model, and
2. emergent model.

Kurt Lewin's Three-Stage Model of organisational change (Lewin 1951) is widely recognised as providing a foundation for the study and implementation of 'planned' organisational change. Lewin's three stages of organisational change are:

1. freezing
2. unfreezing, and
3. refreezing.

The model is based on democratic principles and encourages collaboration and learning among personnel (Benn & Rusinko 2013). By (2005) proposes that three of the most prominent models of planned change are:

1. Kanter, Stein & Jick's Ten Commandments for Executing Change (Kanter, Stein & Jick 1992)
2. Kotter's Eight-Stage Process for Successful Organisational Transformation (Kotter 1996), and
3. Lueckes's Seven Steps (Luecke 2003).

Some scholars have challenged the planned approaches to change because they are seen to be limited in their ability to address the challenges that organisations face in adjusting to continuous changes in their operating environments (Bamford & Forrester 2003). Such changes include technological innovation, globalisation and, often, unpredictable social and demographic trends (Graetz 2000). This has led to a more recent focus on emergent rather than planned models of change.

Characteristics of ‘emergent’ change include a greater emphasis on ‘bottom up’ action in contrast to the ‘top down’ control and comprehensive planning approaches emphasised in models of planned change (Bamford & Forrester 2003). Emergent approaches include process-based change models – the central tenets of which highlight that power and politics are a central component of change and that incremental improvements over time can have significant impacts on an organisation (Dawson 2005).

The intention of this review of the literatures that overlap with and are of relevance to energy management practices is to reinforce the eclectic characteristics of energy management practices. That is, what this thesis refers to as ‘energy management practices’ include practices that cover technical issues such as data, statistical analysis and accounting for the costs and benefits of projects. These are also practices that address the need to educate, engage and motivate a workforce. The review also highlights that efforts to explain the ‘how’ and ‘why’ of change have been relatively neglected. As will be argued in this chapter and Chapter 4, while the actual practices are quite well known, the fundamental challenge is to introduce those new practices into an organisation and then to enact them in ways that lead to improved energy efficiency performance within the context of the organisation’s broader business goals. As has been highlighted in the organisational change literature, attempts to implement change often fail (Balogun & Hailey 2004).Therefore, while this thesis will identify *what* energy management practices organisations have changed over the study period, it is expected that a more significant contribution will be made by providing insights into *how* and *why* new practices are successfully developed and adopted by organisations over time. In particular, Chapter 4 argues that institutional theory (including more recent work on institutional entrepreneurship) is a particularly relevant approach to examine the dynamics of changing energy management practices. To progress the argument, the next section considers the existing research that has examined the *extent* to which energy management practices have been adopted by organisations.

Research that examines the adoption of energy management practices

A number of researchers have examined the extent to which organisations adopt particular energy management practices. In this section of the thesis key studies are reviewed. Then, the strengths and weakness of these studies are analysed and the implications for the thesis are made.

Three key studies are as follows:

1. Christoffersen, Larsen and Togeby (2006) conducted a survey in Denmark of 304 manufacturing organisations, each with more than 19 employees and concluded that between 3–14% of firms practice energy management.
2. Thollander and Ottosson (2010) found that – of the 50 foundries and mills surveyed in their research – 40% of the foundries and 25% of the mills may be considered to have sufficient energy management practices.
3. Ates and Durakbasa (2012) examined 40 energy intensive organisations in Turkey (six iron/steel companies, nine cement companies, seven paper companies, eight ceramics companies and 10 textile companies) and concluded that 24% of the surveyed companies actively practiced energy management.

The researchers established between three and six energy management practices that they considered essential for energy management (marked as ‘primary’ in Table 3.3). In the case of the Christoffersen, Larsen and Togeby (2006) and Ates and Durakbasa (2012) studies, ‘secondary’ energy management practices were also considered. That is, researchers considered that an organisation practices energy management when they exhibited all primary practices together with three out of four secondary practices. Table 3.3 lists the energy management practices that each of these studies examined.

Table 3.3: Energy management practices examined in key studies

	Christoffersen, Larsen & Togeby 2006	Ates & Durakbasa 2012	Thollander & Ottosson 2010
Management support			
Energy policy	Primary	Primary	
Energy efficiency target or implementation goals	Primary	Primary	
Strategy			
Have an energy strategy of three years or longer			Primary
Resourcing			
Have an official energy manager		Primary	
Having a staff awareness program in place to encourage energy conservation and efficiency		Primary	
Seek to actively involve the employees in the work of energy saving by informing, motivating and educating them	Secondary	Secondary	
Clearly allocated responsibilities and tasks	Secondary		
Monitoring of energy use			
Meter the energy consumption of main production processes (e.g. motor, pump, steam and process heat systems)		Primary	
Allocating costs based on sub-metering			Primary

	Christoffersen, Larsen & Togeby 2006	**Ates & Durakbasa 2012**	**Thollander & Ottosson 2010**
Procurement			
Systematically make energy-efficient purchases according to a specified procedure	Secondary	Secondary	
Financing			
Pay-off periods for energy efficiency investments of two years or more			Primary
Implementation			
Projects are implemented	Primary	Primary	

The findings from each of these studies suggest that there is a significant untapped potential for increasing the extent to which organisations adopt energy management practices in order to improve energy efficiency outcomes. Review of these studies highlights some important directions for future research.

First, while these studies provide information about the extent to which energy management practices are adopted, they do provide limited insights into *how* and *why* various energy management practices are developed, selected and implemented. Further, it is not clear from the research whether the respondents consider the energy management practices selected by the researchers to be appropriate to their particular circumstances. Also, conceptualising energy management practices as a state that either 'is' or 'is not' implemented within an organisation at a particular point in time provides limited insight into the varied levels of adoption of energy management practices within organisations and the factors that may influence such variability.

Studies that examine change over time may build on and complement these existing studies by providing insights into the evolution of management practices and how organisations select, develop and adopt such practices. For example, a number of authors suggest that senior management support and energy audits are a first step in energy management (Price & Lu 2011; Thollander & Ottosson 2010). However, there is little empirical evidence that organisations can enhance their energy management performance by introducing energy management practices in a particular order. Further, organisational constraints, such as access to resources, may limit the options available to organisations and, therefore, the energy management practices that they may pursue at a particularly point in time. To address these limitations further research could examine the way in which energy management practices change over time. This approach could also provide important perspectives on the process by which organisations introduce energy management practices into organisations. This is important as it could have a significant impact on the effectiveness of particular energy management practices. Kannan and Boie (Kannan & Boie 2003, p. 957) highlight the importance of examining the way in which organisations introduce energy management practices. They observed that:

> "During the energy auditing, when observing housekeeping practices, the operators felt that they were being observed all the time, and it caused fear/resentment among the operators. This could be overcome by giving adequate training, and awareness should be created with dedicated support of top management. Besides, additional incentives would motivate them to conserve energy."

This thesis will treat energy management practices as a dynamic phenomenon that involves a continuous process of change. The approach aims to build on and complement existing research which has provided important insights into the extent to which particular energy management practices have been adopted by organisations at a particular point in time.

Section summary

This section of the thesis has examined existing research to identify knowledge gaps in the energy efficiency and related literatures. It has found that key energy management practices in the literature include:

- developing and implementing long-term energy strategies
- developing energy policies, targets and goals
- conducting energy audits, and
- developing energy information systems to support the identification and

measurement of improvement options.

The breadth of these practices shows that energy management is a multidisciplinary activity involving both technical practices (e.g. energy analysis) and practices that are more closely related to management tasks (e.g. planning) (Christoffersen, Larsen & Togeby 2006; Kannan & Boie 2003). Further, these practices are not exclusive to energy management (Corbett & Kirsch 2001; Viadiu, Fa & Saizarbitoria 2006). Rather, they are similar to other management approaches, such as environmental management, health and safety management, and quality and production management. There is also a significant crossover with the practices described in the corporate sustainability and organisational change literature.

Important research has been undertaken that examines the extent to which energy management practices have been adopted by organisations in particular industry sectors. This suggests that there has not been widespread adoption of energy management practices (Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006; Thollander & Ottosson 2010). However, it does highlight that there is significant potential to improve the energy efficiency performance of organisations by accelerating the adoption of effective energy management practices.

This academic literature can be further developed to explain:

- the motivations driving the adoption of energy management practices within organisations, and/or
- the process by which organisations identify, develop and implement effective energy management practices.

The next section examines the literature on government energy efficiency policies. It seeks to understand the rationale and extent to which the research has shown that such policies increase the adoption of energy management practices in organisations.

3.4 Policy approaches influencing the adoption of energy management practices

> *"It is noteworthy that most energy efficiency policies and measures are not used in isolation, but are often part of policy packages. Furthermore, the introduction of one policy does not necessarily imply the removal of pre-existing policies applied to the same entities. These aspects demand attention to policy coherence to maintain overall efficacy and cost-efficiency."*
>
> *(Tanaka 2011, p. 6535)*

3.4.1 Introduction

This section examines the range of government policies that have been developed that aim to directly and indirectly influence energy management practices in organisations. It is important to examine these policies since government policies and programs are one of the major drivers for change in energy management practices.

Governments have been developing policies that aim to unlock the energy efficiency potential in organisations since the energy crisis in the 1970s. The energy crisis highlighted the vulnerability of economies to disruptions in energy supply when oil prices rose rapidly and dampened economic growth in countries around the world (Hamilton 2011). Subsequently, governments viewed energy efficiency as an important measure in improving energy security. With the more recent emergence of climate change as a significant issue, governments have renewed their focus on improving energy efficiency in organisations as it typically provides the lowest cost option to reduce greenhouse gas emissions (IEA 2013). At the same time, and as described in Chapter 2, energy efficiency can deliver multiple benefits at the organisational level which then flow out into society, reaping wider societal benefits such as increased productivity, reduced local pollution and the creation of employment opportunities (Ryan & Campbell 2012).

Policymakers face a number of challenges in designing and implementing effective policies. For example, variables that affect the extent to which organisations implement energy efficiency measures include:

- the design of energy markets
- changing economic environments
- business circumstances, and
- managerial priorities (Tanaka 2011).

A wide range of implementation barriers have also been identified (Trianni & Cagno 2012; Tuominen et al. 2012). This means that there is typically no 'one size fits all' policy that will be effective in all circumstances (Christoffersen, Larsen & Togeby 2006). Addressing this diverse range of conditions has led policymakers to develop a range of distinct (yet related) policies that aim to improve energy efficiency.

The term 'policy packages' is used to describe the use of multiple complementary policies that aim collectively to encourage energy efficiency improvements (Jollands 2009; Tanaka 2011). Each measure within a policy package can address the particular barriers that are experienced by different industry groups and stakeholders (Greening & Jefferson 2013; Ürge-Vorsatz & Metz 2009). Governments can enhance the effectiveness of policy measures by combining them in ways that support synergistic effects (Levine et al. 2007). This approach of multiple policies is widely accepted in the literature (Bernstein et al. 2007; Kounetas & Tsekouras 2008; Mallett, Nye & Sorrell 2011; McKane, Price & Can 2007; Price et al. 2005; Tanaka 2008; Worrell et al. 2009; Zhou, Levine & Price 2010).

Since energy policies can play a central role in influencing energy management practices – it is important to understand the different policies that governments may employ. As the analysis reveals – the range of policies do not simply work in isolation to influence practices – rather they interact with one another. Therefore it is important to account for such interactions when examining the factors that influence changes in energy management practices.

The aim of this section of the thesis is not to examine each type of policy mechanism in detail. Rather, it is to explore the scope of government policy options presented in the academic energy efficiency literature and to consider the extent to which different policy measures influence energy management practices directly or indirectly. For example, policies may require organisations to conduct energy audits or to implement an energy management system to meet particular requirements. Such policies will have a direct impact on energy management practices because organisations are required to undertake specific activities.

An example of an indirect policy influencing energy management practices is a government policy that provides a grant for the implementation of an energy efficiency project. To be eligible for the grant, the government may not require the organisation to implement specific practices. However, due to the incentive offered by the grant, the organisation may improve their energy management practices voluntarily and in the manner that the organisation considers most beneficial.

3.4.2 Policies that aim to directly influence energy management practices

Energy audit policies and programs

Energy audit policies and programs are one of the most common energy efficiency policy measures implemented around the world (Anderson & Newell 2004; Schleich 2004a; Tanaka 2011). The policy rationale for requiring firms to conduct energy audits is based on the idea that if managers do not have all the information they need on energy efficiency options, including the approximate cost and benefit of such options and how to deploy them, then it is reasonable to assume that they may have difficulty deciding to invest in these projects (Garnaut 2008). Governments may consider this to be a market failure for which intervention is justified. However, it is generally accepted that such justification should only occur when the cost of implementing the policy is less than the expected benefit (Brown 2001). In particular, a lack of or incomplete information may pose a particular challenge for smaller businesses with limited resources where information may be less readily available (Anderson & Newell 2004; Kounetas, Skuras & Tsekouras 2011).

The complexity of energy efficiency improvement options, including projects that involve significant capital expenditure through to low and no cost operational improvements, present an informational challenge for managers. Furthermore, delivering energy efficiency improvements may require the purchase of products and services that are relatively unfamiliar to managers within a particular firm. Such purchases may come from multiple suppliers and intermediaries. Information asymmetries may occur between purchasers and suppliers and across the supply chain. For example, it can be difficult for a purchaser to verify the claims made by the suppliers of energy efficient equipment without targeted monitoring systems and analysis that accounts for the different variables that may affect the energy efficiency performance of a particular product (Sorrell et al. 2004). Frequently, managers have greater confidence in the information associated with upfront capital costs than information about operating costs. This situation creates an incentive to adopt less efficient options upfront where such options require less upfront capital (Eyre 1997).

An energy audit involves a systematic examination of energy consumption to identify improvement options. The level of detail obtained may vary from 'walk through audits', which aim to identify the most obvious energy saving opportunities, through to detailed and comprehensive reviews of energy use across a facility to identify, evaluate and provide financial information on the costs and benefits of particular energy efficiency measures (Shen, Price & Lu 2012). The widespread application of government energy auditing programs is illustrated in an international review conducted by Price & Lu (2011). The review covered 22 energy audit programs across 15 countries (i.e. Australia, Canada, Denmark, Finland, France, India, Ireland, Japan, the Netherlands, Norway, Portugal, Sweden, Switzerland, the United Kingdom and the United States) and one region (i.e. the European Union). Although the focus of the review was the industrial sector, many of these programs also covered the commercial sector as well. The researchers compared the design components of the programs across a number of criteria, including the cost of energy audits, use of standardised manuals and tools, training and certification of energy auditors, databases of energy audit results, post-audit follow-ups and case studies (Price & Lu 2011).

Some countries have had energy auditing programs over a number of decades. For example:

- In Australia, there have been various energy auditing programs over the past 20 years. The Entreprise Energy Audit program which commenced in 1991 (Harris, Anderson & Shafron 2000) and has been followed by a number of national and state-based energy audit programs, including the Energy Efficiency Best Practice Program, the *Energy Efficiency Opportunities Act*

2006 (Cth) and the NSW Government's Energy Savings Action Plan (Crittenden & Lewis 2011).

- China has had some form of industrial energy auditing program during the last three decades (Price & Lu 2011; Shen, Price & Lu 2012).
- The Mongolian Government is currently developing energy efficiency audit legislation for large energy consuming businesses (Ernedal & Gombosuren 2011).
- In the United States, the U.S. DOE Industrial Assessment Center (IAC) program has been providing energy assessments (at no financial cost) to small and medium-sized manufacturers since 1976 (Anderson & Newell 2004).

In one major study of the outcomes from energy audits in the United States, Anderson and Newell (2004) examined over 39,920 projects from over 9000 manufacturing plant energy reviews listed on the U.S. DOE IAC program database between 1981–2000. The researchers found that firms adopted around 40% of the recommended projects. In commenting about the effectiveness of the program, the authors stated that: "overall, one can view the glass as either half full or half empty" (Anderson & Newell 2004, p. 32). In other words, researchers and policymakers may perceive the program to be a success because of the large number of projects that have been adopted. However, they may also consider the results as relatively poor because the organisations involved did not implement the remaining 60% of cost-effective projects. This example reflects a common difficulty associated with examining the outcomes of energy efficiency audit programs (i.e. determining whether organisations have obtained all the cost-effective benefits identified in the energy audit). This work highlights the need for further research on the effectiveness of energy efficiency assessments and the factors that influence the outcomes achieved, including the underlying energy management practices adopted to conduct the audits (Anderson & Newell 2004; Larsen et al. 2006; Schleich 2004a, 2009). Shen, Price and Lu (2012, p. 354) describe one of the major challenges:

> “Mandated energy audits were sometimes seen by enterprises as a government function rather than as business activity. As such, enterprises somewhat felt that energy audits were an administrative burden as well as a means for exposing problems rather than a process for helping them to become more competitive. As a consequence, enterprises are reluctant to undertake extensive efforts to go beyond their targets and energy auditors often only recommend quick fixes to help the enterprises to meet their obligations.”

The potential consequence is that the focus in such organisations shifts to administrative expediency; that is, completing the energy audit in a way that reduces disruption and costs. As a result, the researchers found that the energy auditors involved in the program frequently recommended quick fixes in order to meet a companies legislative obligations, rather than proposing projects that might deliver more substantive business benefits. This finding is consistent with Ates and Durakbasa (2012) who found that organisations that were required to have energy managers were in charge of administrative positions and typically approached the implementation of such programs as administrative compliance tasks, rather than seeking energy performance improvement. Researchers have identified that they need to understand how organisations respond to mandatory government energy audit programs and the potential unintended consequences of such programs (Ates & Durakbasa 2012; Shen, Price & Lu 2012).

Government energy audit programs often require organisations to use accredited energy efficiency assessors to conduct energy efficiency assessments (Lu & Price 2011; Vine 2005). The expectation is that a skilled technical expert is required to identify all cost-effective energy efficiency projects. However, Helcke et al. (1990) compared energy audits conducted by four different private companies and found a high degree of variation in the results. In other research, Schleich (2004a) undertook a survey of firms in the small industrial enterprises and commercial buildings in Germany and found that the quality of audits undertaken by engineering firms was more effective than those carried out by utilities or industry sector associations. These results reinforce the need for further research examining the factors that influence such variability in outcomes (Anderson & Newell 2004). An important focus in this thesis is on the energy management practices associated with energy auditing in organisations. This is particularly relevant due to the:

- broad application of energy audit programs globally (Lu & Price 2011; Price & Lu 2011)
- role that energy audits play in identifying and establishing the relative cost-effectiveness of energy efficiency projects, and
- call for further research on the effectiveness of energy efficiency assessments (Anderson & Newell 2004; Larsen et al. 2006; Schleich 2004a, 2009).

Energy management policies and programs

Reinaud, Goldberg & Rozite (2012, p. 10) define energy management programs as: "policies and initiatives that encourage companies to adopt energy management". Policymakers typically consider energy audits as one component of a broader set of activities classified as energy management (Price & Lu 2011). For clarity, Table 3.4 highlights the key distinctions between energy audits and energy management programs.

Table 3.4: Distinction between energy audits and energy management

	Energy audit	**Energy management**
Objective	Establish a costed list of energy efficiency measures for decision-makers to consider	Encourage the implementation of systems and processes that support a continuous focus on energy performance
Timeframe	Distinct activity with a start and finish (e.g. three days to three months), typically undertaken on an episodic basis (e.g. once every three to five years)	Permanent and continuous activity associated with ongoing cycles of implementation, review and improvement
Skills required	Technical skills associated with identifying and evaluating potential energy efficiency improvement opportunities	A range of management skills is required, from policy development through to the communication of energy management across an organisation

As governments have sought to encourage the application of energy management systems within organisations, they have developed a set of protocols and standards that define the activities and outcomes associated with energy management. The benefits of the standardisation of management practices may reduce variation in the application of particular management practices, facilitate comparison within and across firms, allow for third party certification to provide assurance as to whether standards have been met and structure product and service offerings of consulting firms (McKane, Price & Can 2007; Price, Wang & Yun 2010). The standardisation process involves transforming a set of loosely described practices into a more closely defined set of generally accepted rules for the way in which a particular management practice should be applied (Perkmann 2008). Companies themselves, industry groups, governments or international bodies (e.g. the International Organization for Standardization (ISO)) may initiate and support the standardisation process.

Researchers have identified a number of limitations and unintended consequences associated with government programs and the standardisation process. For example, McKane, Scheihing and Williams (2008) argue that technical specialists (e.g. in-house engineers and external energy consultants) are typically the main personnel involved in identifying and implementing energy efficiency projects. Limitations of this approach include the following:

- Non-technical staff in an organisation may not understand the approach since they do not have the requisite technical expertise.
- These practices and technologies penetrate the market slowly.
- Once individuals leave the organisation, the motivation for and expertise to progress energy efficiency may be lost.

The authors suggest that energy management projects and associated energy management systems be developed through a consensus approach by involving the personnel that are required to implement the system in the design of the system itself. However, it is unclear how organisations might accomplish such consensus once a standardised framework is already established. That is because once energy management systems are standardised, there is a risk of personnel viewing the standardised practices as a prescriptive form of compliance. This highlights an important tension between standardisation and engagement.

This unintended consequence of standardisation is similar to the observation made by Shen, Price and Lu (2012) regarding the ‘administrative’ response by Chinese organisations to the requirement to conduct mandatory energy audits. Organisations may aim to implement an energy management system to a minimum standard to meet compliance requirements; however, organisations may achieve better results where they view energy management systems as an opportunity to achieve wider business benefits.

There has been an extensive multi-stakeholder process to develop the new energy management system standard ISO 50001 (ISO 2011; McKane et al. 2008; Reinaud, Goldberg & Rozite 2012). However, despite the widespread support for the new energy management system standard, limited evidence exists which indicates the extent to which such approaches are successful.

If we look to the considerable research undertaken for the implementation of environmental management systems and the international standard ISO 14000 – Environmental Management, we can obtain some useful insights into potential issues that may arise with the wider implementation of energy management systems.
For example, Nawrocka & Parker (2009) examined 23 studies that aimed to identify the link between environmental performance in firms and the implementation of environmental management systems. They were unable to identify a clear link, which suggests that there is wide variation in the effectiveness of systems across different firms. Könnölä and Unruh (2007) suggest that a major limitation of standardised management systems such as ISO 14000 is that they are likely to encourage incremental improvement, but may have the unintended effect of limiting the identification and implementation of more radical improvements in environmental performance. Yin and Schmeidler (2009) found wide variability in the implementation of ISO 14000 and suggest that differing implementation approaches may account for the wide variation in environmental performance across the firms involved in the study. These findings highlight the importance of research that examines the extent to which government-directed energy management programs, in encouraging organisations to conduct an energy audit or to adopt a standardised energy management system, are effective. One way to achieve this is to examine the energy management practices organisations apply that have successfully

demonstrated energy efficiency improvement. This is an approach that will be discussed further in Chapter 6 of this thesis.

3.4.3 Policies that aim to indirectly influence energy management practices

Since the oil crisis of the 1970s energy efficiency policies have evolved. The following section incorporates a brief review of these policies. It is not intended to be a complete review or critique. Rather the wide scope of the different policies further reinforce the complexity of the policy challenge associated with improving energy efficiency improvements. Table 3.5 presents a list of key policies and associated authors.

Table 3.5: Energy efficiency policy mechanisms

Policy instrument	Key references
Control and regulatory mechanisms	
Appliance standards	Garcia et al. 2007; Park et al. 2009; Tenbrunsel et al. 1997; Wiel & McMahon 2003.
Building codes	Iwaro & Mwasha 2010; Nelson 2012.
Labelling and certification programs	Dixon et al. 2010; Dixon, Keeping & Roberts 2008; IEA 2010a.
Energy efficiency obligations and quotas	Bertoldi et al. 2013; Bertoldi et al. 2010; Rosenow 2012.
Financial and market-based instruments	
Energy performance contracting/ Energy service company (ESCO) support	Painuly et al. 2003; Vine 2005.
Energy efficiency certificate schemes	Bertoldi et al. 2010.
Kyoto protocol flexible mechanisms	Lee et al. 2013.
Taxation (on CO_2 or fuels)	Klok et al. 2006; Lu, Tong & Liu 2010.
Tax exemptions/reductions	Bjørner & Jensen 2002.
Capital subsidies, grants, subsidised loans	Olmos, Ruester & Liong 2012.
Support, information and voluntary action	
Voluntary and negotiated agreements	Paton 2001; Price, Wang & Yun 2010.
Education and information programs	Anderson & Newell 2004; Matisoff 2013.

Control and regulatory mechanisms include the development of appliance standards (Park et al. 2009), building codes (Nelson 2012), labelling and certification programs (IEA 2010b), and energy efficiency obligations and quotas (Bertoldi et al. 2013). With regard to energy management practices in organisations, there is a risk that control and regulatory mechanisms encourage organisations to focus on minimum standards and compliance, rather than ‘good or excellent performance’ (Garcia et al. 2007). From the perspective of energy management practices, this raises questions about whether such standards encourage minimum performance or encourage continuous improvement (Shen, Price & Lu 2012; Wiel & McMahon 2003).

Financial and market-based instruments aim to modify the financial costs and benefits associated with energy efficiency projects (Fischer & Newell 2008). For example, governments have introduced a price on greenhouse gas emissions in some countries. In Australia, this has taken the form of a fixed price period of three years in which the cost of one tonne of carbon dioxide equivalent will be an inflation-adjusted AUD23/tonne. However, as Lo and Spash (2012) argue, the design of the scheme is unlikely to achieve its purpose due to ongoing subsidies to polluters. They highlight that the political process has contributed towards a significant modification of the design. Indeed the political nature of this policy continues to be challenging and at the time of writing the Australian Government led by Prime Minister Abbott is attempting to repeal the carbon price legislation. Other fiscal policies include grants, subsidies, loans and tax relief (Price et al. 2005).

Support, information and voluntary action policies and programs aim to increase awareness of energy efficiency projects. Programs include educational workshops, training programs, advertising and the development of case studies and material that describes energy efficiency opportunities and particular energy management techniques (Anderson & Newell 2004; Matisoff 2013). Governments typically combine information and voluntary programs with other measures. For example, Denmark has combined taxes on greenhouse gas emissions with energy efficiency agreements in which companies are required to undertake energy audits and implement all projects that have payback periods of less than four years. The companies receive subsidies of 30–50% of the cost of energy efficiency investments (Price et al. 2005). However, organisations still need to be able to have identified the potential projects and to make time available to apply for and take-up the loans and grants on offer. This underscores the important linkage between policies intended to influence energy management practices and policies that operate more directly in the market.

While a full analysis of the policies that indirectly influence energy management practices is beyond the scope of the review presented in this thesis, the intention of this brief overview is to highlight the complexity of energy efficiency policies that form a part of energy efficiency policy packages. Researchers have highlighted that there are challenges in differentiating between the relative influence of each individual policy, and that there is an important need to examine the way in which policies interact together to influence energy management practices and energy efficiency outcomes (Bernstein et al. 2007; Jollands et al. 2010; Tanaka 2011).

3.4.4 Section summary and conclusions

This review of existing literature on energy efficiency policies illustrates the importance of considering how energy efficiency policies interact in order to encourage improved energy performance in organisations. Governments may design policy measures to influence energy management practices directly through energy audits and energy management system programs. Other policies have less direct influence on actual energy management practices. There is a knowledge gap associated with our understanding of how individual policy measures interact to, on the one hand, encourage firms to adopt more effective energy management practices and, on the other, to improve their energy efficiency performance. Therefore, the research that is undertaken in this thesis into *how* and *why* energy management practices change will also include consideration of the way in which multiple energy efficiency policies interact to encourage the adoption of effective energy management practices. See section 5.8 for further information on how this informs the research approach.

3.5 Chapter summary and conclusions

This chapter aimed to present a review of the existing literature to identify what is known about energy management practices and to highlight knowledge gaps in the literature. As mentioned previously, this review established the definition of energy management that will be applied in this thesis. That is:

> "Energy management practices are activities recognised by a community as the legitimate means of coordinating around energy use in accordance with the goals of an organisation."

The review found that key energy management practices promoted in the literature includes:

- developing and implementing long-term energy strategies
- developing energy policies, targets and goals
- conducting energy audits, and
- developing energy information systems to support the identification and measurement of improvement options.

The breadth of these practices illustrates that energy management is a multidisciplinary activity involving both technical practices (e.g. energy analysis) and practices that are more closely related to management tasks (e.g. planning) (Christoffersen, Larsen & Togeby 2006; Kannan & Boie 2003). These practices are not exclusive to energy management (Corbett & Kirsch 2001; Viadiu, Fa & Saizarbitoria 2006) and are similar to other management approaches, such as environmental management, health and safety management, and quality and production management. There is also a significant crossover with the practices described in the corporate sustainability and organisational change literature.

Important research has been undertaken that examines the extent to which energy management practices have been adopted by organisations in particular industry sectors. This suggests that there has not been widespread adoption of energy management practices (Ates & Durakbasa 2012; Christoffersen, Larsen & Togeby 2006; Thollander & Ottosson 2010). On the positive side, this suggests that there is significant potential to improve the energy efficiency performance of organisations by accelerating the adoption of effective energy management practices.

This academic literature can be further developed to explain:

- the motivations driving the adoption of energy management practices within organisations, and
- the process by which organisations identify, develop and implement effective energy management practices.

These issues (i.e. understanding the process by which more effective management practices are developed and adopted within organisations), are common challenges identified in the broader management and practice literature (e.g. corporate sustainability, environmental management, organisational change). Therefore, examining the case of changing energy management practices is valuable in highlighting ways in which the gap between actual and optimal energy use in firms can be addressed to reduce greenhouse gas emissions and deliver a range of other economic, environmental and social benefits *as well as* providing greater insight into the development and spread of new energy management practices more generally. Thus, this review suggests that an appropriate research question is: *How* and *why* do energy management practices change?

Based on the findings, this review has argued that, to better understand how policymakers and organisational practitioners can accelerate the adoption of effective energy management practices, energy management practices should be examined as a dynamic phenomenon. Further, the review of the energy policy literature has highlighted the many complexities associated with designing and implementing policies and programs that aim to encourage energy efficiency improvement in organisations. Due to this complexity, policymakers typically develop policy packages in which multiple measures target different energy end uses, industry sectors and organisational types. This review has also highlighted that it can be difficult for policymakers to establish *how* such policies interact and the extent to which policies and programs influence the successful adoption of energy management practices. For example, many governments have developed energy audit programs, yet organisations do not implement around half of the seemingly cost-effective energy efficiency projects available to them. An unintended consequence of energy efficiency policy may include organisations viewing such policies as an impost. This can lead organisations to adopt an administrative response rather than viewing energy efficiency as an opportunity to improve their profitability and competitiveness. Further, multiple stakeholders external to organisations influence the extent to which effective energy management practices are adopted. These include energy managers, energy consultants and the government departments developing and implementing energy efficiency policies. These findings further reinforce the relevance of examining the dynamic process by which organisations develop and implement energy management practices. They also inform the three research sub-questions:

1. Who are the key organisational stakeholders that have an interest in energy management practices and how do they interact and influence the development and adoption of these practices?
2. How do corporate personnel with responsibility for energy efficiency improvement (referred to as ‘corporate energy practitioners’ in this thesis) influence the disruption, development and maintenance of energy management practices?
3. How does the organisational and organisational field-level context influence individual decision-making on energy efficiency projects?

The next chapter (Chapter 4) reviews the existing literature with regard to the barriers to energy efficiency improvement in organisations. The review will inform the development of an appropriate theoretical perspective that this thesis will apply to the primary research question and three sub-questions.

4. Four perspectives on energy efficiency barriers

> *"The change in thinking required of the sustainability agenda will never come to fruition within practical domains unless proper attention is given to the sources of individual and social resistance to change."*
>
> *(Hoffman & Bazerman 2007, p. 85)*

4.1 Introduction

Chapter 3 reviewed the energy efficiency literature examining energy management practices. The key research question that this thesis will consider emerged from that chapter; that is: *How* and *why* do energy management practices change?

The aim of Chapter 4 is to review the energy efficiency literature to inform the formulation of an appropriate theoretical 'approach' for this research.

Chapter 4 proceeds in the following way. First, the chapter will introduce the literature on energy efficiency barriers with reference to the range of barrier typologies that researchers have developed. Second, the barriers literature will be examined from four perspectives:

1. a neoclassical economic perspective
2. a behavioural perspective
3. an organisational-level perspective, and
4. an interorganisational perspective.

Third (and finally), the key findings from the review of the barriers literature will be discussed in relation to the selection and development of a theoretical framework to be formulated and applied in this research.

4.2 Barrier typologies explaining the energy efficiency gap

The dominant methodological approach to understanding the energy efficiency gap in the energy efficiency literature involves barriers analysis (Shove et al. 1998; Sorrell 2004; Trianni & Cagno 2012). According to Sorrell et al. (2000), a barrier is: "a postulated mechanism whose outcome is an organisations neglect of (apparently) cost-effective energy efficiency opportunities." Weber (1997) describes barriers analysis as being a methodology based on answering the following three key questions:

1. *What* are the obstacles or barriers that limit the uptake of an energy efficiency initiative? (Examples include technical standards, regulations, economic interests, financial incentives and people.)
2. *Who* does the barrier hinder? (The 'who' may include firms themselves, government, or individual managers or other people and groups within or external to the target firm.)
3. *What* action is being constrained? (Examples of constrained actions might include difficulties associated with purchasing more efficient equipment, implementing a government policy or improving operating practices.)

The key research question explored through barriers analysis is then: "*What* is an obstacle *to whom* in reaching *what* outcome in energy efficiency?" (Weber 1997, p. 834).

Researchers have applied barriers analysis to develop typologies of energy efficiency barriers. A selection of prominent typologies is listed in Table 4.1.

Table 4.1: A selection of 'barriers' from the energy efficiency literature

Author/s	Barriers
Blumstein et al. (1980)	Misplaced incentives, lack of information, regulation, market structure, financing, custom
Brown (2001)	Misplaced incentives, distortionary fiscal and regulatory policies, unpriced costs, unpriced benefits, insufficient and inaccurate information, low priority of energy issues, capital market barriers, incomplete markets for energy efficiency
IEA (2003) Jollands et al. (2010)	Price distortion, information, buyers risk, transactions costs, bounded rationality, finance, inefficient market organisation, insufficient/excessive/inefficient regulation at a national or international level, capital stock turnover rates, uncompetitive market price, technology-specific barriers
IPCC (2001)	Technological innovation, prices, financing, trade and environment, market structure and functioning, institutional frameworks, information provision, social, cultural and behavioural norms and aspirations
Painuly and Reddy (1996)	Technical, institutional, financial, managerial, costs and information
de Almeida, Fonseca and Bertoldi (2003)	Awareness of the options, technical options, economic barriers, internal conflicts and market structure.
Stern (2007)	Financial and 'hidden' costs and benefits, multiple objectives, conflicting signals or information and other market failures, and behavioural and motivational factors
Sorrell, Mallet & Nye (2011) Sorrell et al. (2004) Sorrell et al. (2000)	Risk, imperfect information, hidden costs, access to capital, split incentives, bounded rationality

Barriers are postulated from a range of theoretical traditions (Palm & Thollander 2010; Sorrell et al. 2000). A neoclassical economic perspective is dominant in the energy efficiency literature (Brown & Duguid 2001; Jaffe & Stavins 1994b; Rigby 2005; Sorrell 2004). Other theoretical traditions that have been applied to the examination of energy efficiency barriers include behavioural economics, psychology, various organisational theories, and sociological perspectives.

Despite the widespread adoption of the barriers approach, there are a number of important limitations have been identified. For example, differences in the classification and interpretation of barriers present a challenge for researchers and policymakers (Sorrell, Mallett & Nye 2011). As discussed, contributing to such differences is the range of theoretical perspectives that inform each of the various typologies (Lutzenhiser 1993; Wilson & Dowlatabadi 2007). Other limitations of a barriers approach include barriers not being directly observable (Weber 1997) and, where it is assumed that barriers are not interlinked, then there is a tendency for empirical research to adopt a reductionist perspective (Palm & Thollander 2010).

Some authors suggest that an interdisciplinary perspective is one way of addressing these limitations (Jollands & Patterson 2004; Palm & Thollander 2010). Surfacing the underlying theoretical assumptions that may become 'taken-for-granted' by researchers in particular disciplines can help to address some of the confusion and limits to collaboration currently apparent in the academic literature and policy discourse (Breukers et al. 2011; IEA 2003; Lopes, Antunes & Martins 2012; Shove 1998). Efforts to separate different disciplinary perspectives inevitably involve some blurring and overlap (Sorrell et al. 2004). However, critically examining these different perspectives can help to address the institutionalisation of knowledge which has the potential to reinforce ineffective approaches and limit the generation of new knowledge about the reasons for the energy efficiency gap and the actions that might be undertaken to address them (Shove 1998).

The following review adopts four broad perspectives to categorise the literature by taking account of underlying disciplinary perspectives together with the levels of analysis at which research and interventions are targeted. The four perspectives considered are:

1. neoclassical economics
2. behavioural

3. organisational, and
4. interorganisational.

The aim of this section of the chapter is not to examine each of the barriers in detail. Rather it is to examine the main barriers that are highlighted from a range of disciplinary perspectives and levels of analysis and to consider how the barriers perspective informs our understanding of energy management practices. The central assumptions, levels of analysis and limitations of each perspective will be discussed prior to conclusions being drawn that will inform the formulation of the theoretical framework to be applied in this research. Ultimately, the review will highlight the need for and value of a multidisciplinary focus in order to better synthesise the particular strengths of each of the various perspectives.

4.3 The neoclassical economic perspective on the energy efficiency gap

A neoclassical economic perspective is dominant in the energy efficiency literature (Brown & Duguid 2001; Jaffe & Stavins 1994b; Rigby 2005; Sorrell 2004). Within the energy literature, other terms used that are considered under the umbrella term of 'neoclassical' include 'conventional' (Paton 2001), 'orthodox' (Sorrell 2004), 'mainstream' (Gowdy 2004; Marechal & Lazaric 2010) and 'basic' (Horowitz 2001).

The main focus of neoclassical economics is the efficient allocation of scarce resources through markets which 'permit mutually advantageous exchanges' (Stilwell 2002, p. 147). The neoclassical economic perspective places a central emphasis on the influence of markets and prices to explain the energy efficiency gap. As Croucher (2011b, p. 5798) describes it:

> "With regards to energy efficiency the majority of the barriers ultimately come down to money ..."

In fundamental terms, when prices for energy are relatively low, then a neoclassical perspectives assumes that firms might be expected to increase their use. When energy prices increase, then the opposite might be expected to occur (Biggart & Lutzenhiser 2007). Howarth, Haddad & Paton (2000, p. 478) suggest that firms and the managers within them are assumed to operate as:

> "… well-informed, rational actors that systematically maximise profits subject to the constraints imposed by technology, public policy, and prevailing market conditions ..."

Where there is evidence that profitable energy efficiency projects are not being implemented within firms, adopting a neoclassical economic perspective leads to analysis of the market to identify reasons for market failures or imperfections. Then, to justify policy interventions, it is important to demonstrate that the costs of implementation do not exceed the overall benefits across the economy as a whole (Brown 2001).

Within the energy efficiency literature, attempts have been made to distinguish between market failures and market barriers. As defined by Brown (2001, p. 1199), market failures:

> "… occur when there is a flaw in the way markets operate. They are conditions of a market that violate one or more of the neoclassical economic assumptions that define an ideal market for products or services such as rational behaviour, costless transactions, and perfect information."

The category 'market barrier' is a much broader term which aims to capture all other barriers that are not deemed to be market failures, yet contribute towards the slow diffusion of energy efficiency improvements (Brown 2001; Jaffe & Stavins 1994a). Key market failures and barriers from a neoclassical economic perspective are defined in Table 4.2 and then discussed in the paragraphs that follow.

Table 4.2: Key barriers from the neoclassical economics perspective

Barrier	Description
Unpriced costs (externalities)	The price of energy does not reflect the full costs associated with the discovery, extraction, production, distribution and consumption of the energy.
Distortionary fiscal and regulatory policies	Tax and fiscal policies devalue the benefits of energy efficiency projects.
Misplaced incentives	The benefits from an energy efficiency project accrue to a person or group other than the person or group that provides the resources required to implement the project.
Insufficient and inaccurate information	The information required to make an informed investment decision is not available to the decision-maker/s.
Low priority of energy issues	Other business priorities are considered more relevant than energy saving initiatives, even where there are financial benefits.
Capital market barriers	Organisations may have difficulty in accessing the capital required for implementation of projects, even when projects are considered to be cost-effective.
Hidden costs	Costs associated with obtaining information and managing energy use are perceived to be greater than the expected benefits.
Risk	Factors other than cost-effectiveness may influence the decision to implement an energy efficiency project; for example, if a project presents technical or operational risk.

(Source: Adapted from (Brown 2001, p. 1199) and (Sorrell et al. 2000, p. xvi))

Unpriced costs (externalities)

Energy prices may not reflect the true cost of energy. A report by the American National Research Council found that many costs from the discovery, extraction, production, distribution and consumption of fuels were not taken into account within energy prices. As well as environmental costs, many social costs were identified, including community health issues (National Research Council 2010). A recent report by the Australian Energy Market Commission highlighted a number of deficiencies in market signals that do not encourage energy efficient actions by energy consumers. These include a lack of visibility of the true costs of energy as it is supplied at different times of the day, limited access to consumption information and a lack of financial recognition for energy efficiency initiatives that benefit the market as a whole (Australian Energy Market Commission 2012). Even in large energy consuming businesses, information on energy use that is available from an energy retailer may be limited and difficult to obtain. For example, the price may not account for the different costs of generating energy over a 24-hour period. If this information was available, then it is expected that the market signal would encourage more efficient use at particular times (Eyre 1997; Hirst & Brown 1990; Steinfeld, Bruce & Watt 2011).

Distortionary fiscal and regulatory policies

Other influences on the market price of energy are tax and fiscal policies. For example, the taxation rules in the United States require the capital costs associated with commercial building investments to be depreciated over more than 30 years. In contrast, operating costs can be fully deducted from taxable income. Since energy efficient technologies typically have a higher capital cost, this type of tax arrangement penalises energy efficiency initiatives (Brown 2001). Tax and fiscal policies can also be used to *encourage* the uptake of energy efficiency. Taxes and fees increase the costs associated with energy use. Examples include energy and carbon taxes and pollution levies. Public benefit charges or energy efficiency standards in the electricity sector are commonly used in the United States. These require energy utilities to provide funds for programs aimed at improving the energy efficiency performance of their customers, including residential users and organisations. It is estimated that USD2.7b was allocated to encouraging the adoption of energy efficiency measures in 2007, and this will increase to USD5.4b in 2010 (Croucher 2012).

Misplaced incentives

Also referred to as the principal-agent problem or split incentives, misplaced incentives are said to: "occur when an agent has the authority to act on behalf of a consumer, but does not fully reflect the consumer's best interest" (Brown 2001, p. 1199). For example, a property owner is likely to be the decision-maker in determining whether to upgrade a building, yet the benefits of the upgrade will accrue to the tenant in the form of reduced energy costs (IEA 2007). A contributing factor is information asymmetry, which describes the situation where one party has more knowledge than another (Sorrell et al. 2000).

Insufficient and inaccurate information

From a neoclassical economic perspective, policy measures that increase the cost of energy or incentivise energy efficiency might be expected to increase the likelihood that firms will improve their energy efficiency performance. However, sufficient, accurate and cost-effective information is considered an essential characteristic of a functioning market (Brown 2001). If managers do not have all the information they need on energy efficiency options, as well as the approximate costs, benefits and information on how to deploy such options, then it is reasonable to assume that they may have difficulty deciding to invest in related projects (Garnaut 2008). Policy interventions that influence energy prices will not be optimised if such changes are not 'seen' by decision-makers in organisations due to a lack of information. Therefore, so-called 'information measures', such as energy auditing, may be considered to be policies that complement financial measures (Larsen et al. 2006).

The complexity of energy efficiency improvement options, including projects that involve significant capital expenditure, through to low and no-cost operational improvements, also present an informational challenge for managers. Furthermore, delivering energy efficiency improvements may require the purchase of products and services that are relatively unfamiliar to managers within a particular firm. Such purchases may come from multiple suppliers and intermediaries.

Information asymmetries may occur between purchasers and suppliers across the supply chain. For example, it can be difficult for a purchaser to verify the claims made by suppliers of energy efficient equipment without targeted monitoring systems and analysis that accounts for the different variables that may affect the energy efficiency performance of a particular product (Sorrell et al. 2004). Frequently, managers have greater confidence in the information associated with upfront capital costs than information about operating costs. This situation creates an incentive to adopt less efficient options upfront where such decisions require less upfront capital (Eyre 1997). Another form of information failure is adverse selection. This describes the situation in which suppliers have more information about the energy efficiency attributes than a purchaser of the equipment. Purchasers will tend to select equipment based on price without having the knowledge of the full benefits associated with the more energy efficient equipment. This means that they may be less likely to pay a price premium for more efficient equipment (Sorrell et al. 2000).

Market barriers including priority, capital constraints, hidden costs and risk
Due to energy costs being a relatively small proportion of overall costs, businesses may have limited interest and concern to improve energy efficiency (relative to other opportunities in a business), making energy efficiency a low priority in the organisation (Brown 2001; Sorrell 2004; Trianni et al. 2013). The low priority for energy efficiency may be exacerbated by the difficulties an organisation may face in accessing the capital required to implement projects (Hasanbeigi, Menke & Pont 2009; Rohdin, Thollander & Solding 2007). The lack of investment in energy efficiency may also be due to perceptions of or actual risk associated with energy efficiency projects. This will particularly be the case where there is insufficient experience within the organisation or across an industry sector with a particular technology or practice that appears to have a good financial return, but for which there is limited corroboration of the results (Fleiter, Worrell & Eichhammer 2011; Sorrell et al. 2004; Trianni & Cagno 2012).

4.3.1 Limitations of the neoclassical perspective

Neoclassical economic perspectives have been criticised for their inability to explain and influence the behaviour of the multiple actors involved in energy efficiency decision-making (Cebon 1992). At the core of this critique is the presupposition of individual actors as: “autonomous and rational individuals unaffected by others” (Biggart & Lutzenhiser 2007, p. 1075). Research often depicts individual decision-makers within firms, as if they make decisions ‘in a vacuum’ without considering social and institutional influences (Palm 2009; Shove et al. 1998). Jollands and Patterson (2004) highlight that the traditional economic focus on the direct effects of an action within closed systems means that wider flow-on effects are typically ignored.

DeCanio (1993) challenges the neoclassical economic assumption that firms are conceptualised as acting with: “a single mind … with its own consciousness”. He points out that firms are a collection of individuals. DeCanio suggests that decisions are made by such individuals working together in ways that are influenced by a complex set of written and unwritten contracts. As well as being influenced through the interaction amongst the many different individuals comprising a firm, they are further influenced by the rules of government and the interactions amongst employees. Therefore, taken alone, there is a risk that attempts to address the barriers identified may not be sufficient to optimise energy use in an organisation.

Table 4.3 provides a summary of the neoclassical perspective. It considers central assumptions, key references, primary levels of analysis and limitations.

Table 4.3: Summary of the neoclassical perspective

Aspect	Description
Central assumptions	Functioning markets are the most efficient way of allocating scarce resources Individuals and organisations behave as ‘rational actors’
Key references	Brown 2001; Croucher 2011b; Horowitz 2001; Patterson 1996; Sorrell et al. 2004; Sorrell et al. 2000; IEA 2003.
Primary levels of analysis	The market and individual decision-makers within organisations
Limitations	May not allow for consideration of the range of factors that may influence individual and organisational decision-making beyond ‘rational’ action – particularly wider organisational, social and institutional influences

4.4 The behavioural perspective on the energy efficiency gap

Behavioural perspectives in the energy efficiency literature seek to explain how individuals make decisions about and use energy. This understanding is then used to inform measures that are targeted at changing individual behaviour (Hoffman & Henn 2008). One of the fundamental questions that a behavioural perspective seeks to answer is: What are the systematic constraints and biases that influence individual decision-making on investments in and use of energy? (Hoffman & Henn 2008)

Two broad approaches are apparent in the behavioural energy efficiency literature:

1. behavioural economics
2. psychology-based theories.

Behavioural economics typically focuses on the way in which investment decisions are made. That is, researchers examine the factors that influence decision-makers towards investment in technologies and practices that deliver improved energy efficiency (Lopes, Antunes & Martins 2012; Sorrell et al. 2004). Psychology-based theories have been applied to understand how the habitual behaviours of energy users lead to the inefficient use of energy (Gynther, Mikkonen & Smits 2011; Lopes, Antunes & Martins 2012). Behaviour-related research on energy efficiency in organisations has been relatively limited. Estimates of the extent to which behavioural aspects contribute to the energy efficiency gap vary widely and are under-researched (Levine et al. 2007; Lopes, Antunes & Martins 2012). Three key barriers from the behavioural perspective are defined in Table 4.4 and then discussed in the paragraphs that follow.

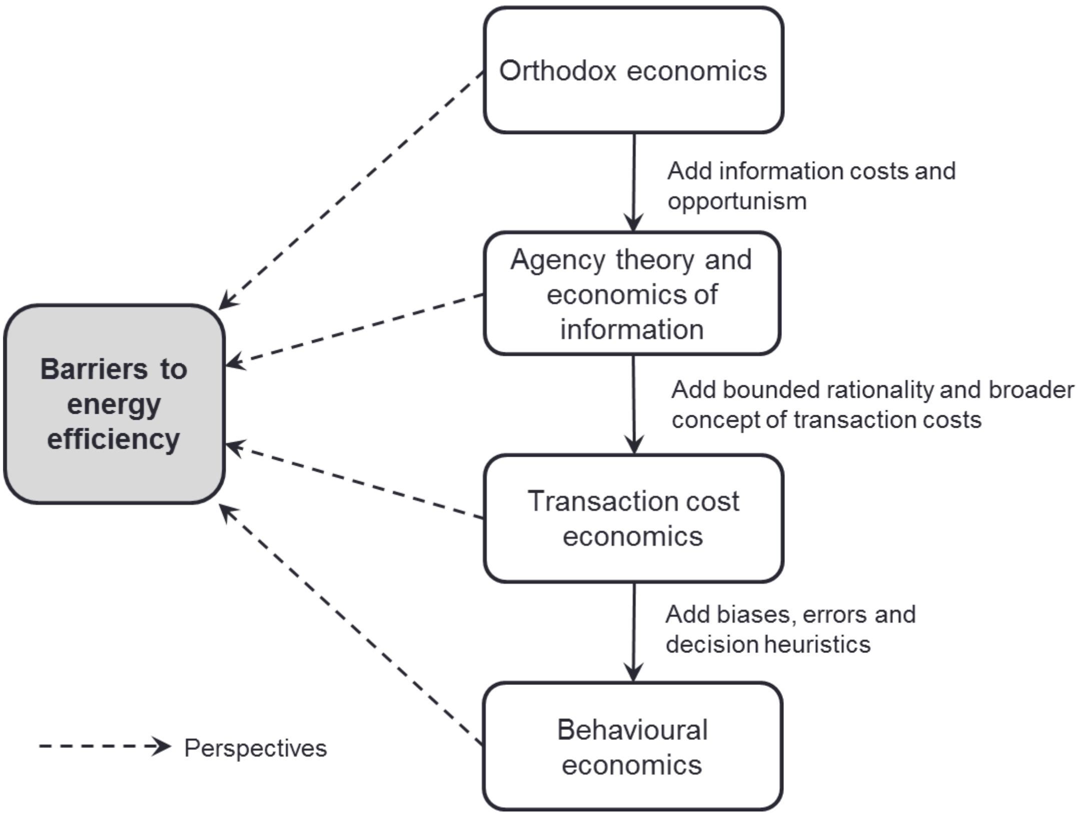
Table 4.4: Key energy efficiency barriers from a behavioural perspective

Barrier	Description
Bounded rationality	Decision-making is limited by the time, attention and resources available to individuals to process information
Personal values and beliefs	Information provided to and reviewed by decision-makers is filtered by the personnel involved and the decision-makers themselves based on their values and beliefs
Limited incentives	Even where there are perceived objective benefits, without a personal incentive to act, progress on energy efficiency improvement may not be forthcoming

It is important to note that behavioural perspectives typically share many of the assumptions of neoclassical economics. Figure 4.1 illustrates how different economic perspectives loosen particular assumptions about people and decision-making that are held within the neoclassical perspective (labelled as 'orthodox' economics in Figure 4.1). The following review will not detail each of these economic perspectives; rather, it will highlight the key barriers as they have been presented in the energy efficiency literature as 'behavioural' barriers. Figure 4.1 also presents a useful reminder of the challenges associated with categorising theoretical assumptions and barriers. Inevitably, there is a degree of overlap. However, the purpose of this review is to highlight the key strengths and weaknesses of each perspective, rather than to create a definitive categorisation of each barrier.

Figure 4.1: Extending the orthodox (neoclassical) economic model applied to energy efficiency barriers

(Source: Adapted from Sorrell et al. 2004, p. 51)



Bounded rationality

Unlike neoclassical economic perspectives, behavioural economics assumes that there are limits to the ability of individuals to process information and that decisions and decision-making may be influenced by personal values and beliefs as well as incentives. The notion of bounded rationality explains the influence of limited time, attention and resources on the ability of individuals to process information (Foss 2003; Simon 1959; Sorrell et al. 2004). Simon (1979) argues that the notion of bounded rationality is particularly relevant for situations in which decision-making occurs under conditions of uncertainty. Acknowledging that individuals have cognitive limits allows for consideration of systematic biases, errors and politically-influenced behaviour. These are not typically considered in traditional economic approaches (Hoffman & Henn 2008; Paton 2001).

One important behavioural bias identified in the literature is the tendency for decision-makers to over discount the future. As Bazerman (2008, p. 4) puts it: "Would you prefer $10,000 today or $12,000 in a year?" Tversky and Kahneman (1991) demonstrated that uncertainty has an important influence on the tendency towards short-term gains and that people have a tendency to prefer avoiding loss than acquiring gains. The uncertainties associated with energy efficiency projects include:

- the future price of energy (Schleich 2004b)
- whether a project will be successfully implemented (Thollander, Rohdin & Moshfegh 2012)
- whether the projected savings will actually be achieved (Rohdin, Thollander & Solding 2007), and
- hidden costs (Sorrell, Mallett & Nye 2011; Sorrell et al. 2004).

The influence of uncertainty and the tendency for managers to over discount the future has been identified in a number of empirical studies as a barrier to energy efficiency (e.g. Anderson & Newell 2004; Harris, Anderson & Shafron 2000; Schleich 2004a). The perceived risk associated with a new, untested or unfamiliar technology, which may impact on product quality and cost, has been found to be a strong deterrent to implementing energy efficiency projects (U.S. DOE 1996). The implications of these studies are that simple financial measures alone do not determine the decision to invest in energy efficient technologies, and that a lack of familiarity of a decision-maker with energy efficiency projects and limited time to obtain the background and knowledge required, can contribute towards under investment in energy efficiency projects.

Personal values and beliefs

Personal values and beliefs have also been shown to influence decision-making on energy efficiency projects. These may work to the advantage of or against decisions on energy efficiency projects. For example, Rohdin & Thollander (2006) found that personal beliefs may prejudice decision-makers *towards* the implementation of energy efficiency projects. In one of the interviews undertaken as part of a qualitative study of eight Swedish industrial firms, the executive director at one firm explained that: "We do not work with this (investment criteria); we implement the things we believe in" (Rohdin & Thollander 2006, p. 1841). This suggests that formal investment criteria were not as important in influencing the decision as underlying management beliefs in some cases.

One powerful belief that has been extensively considered in the literature is that projects that deliver an environmental benefit must have a negative impact on a company's profitability. The term 'Mythical fixed-pie' was coined by Bazerman (1983) to describe negotiated agreements in which the interests of two parties lead to a joint benefit. Despite the joint benefit, the parties believed that win-win outcomes are simply not achievable because they think their interests directly conflict with the interests of another party. Hoffman and Henn (2008) discuss the notion of 'mythical fixed-pie' in the context of energy efficiency. They highlight that deeply held beliefs by managers that environmental benefits must directly conflict with profits mean that energy efficiency projects framed in this way may be rejected.

Porter and van der Linde (1995) describe the influence of individual beliefs in relation to regulation on environmental and energy issues. They suggest that environmental regulation can deliver net benefits to companies in certain circumstances. Benefits occur when the regulation acts as a catalyst for innovation. Porter and van der Linde describe these benefits as 'innovation offsets', in that the benefits to the firm offset the administration and resources required to achieve compliance. The strength of the debate around whether or not environmental regulation can deliver net benefits may in part be due to fundamental beliefs about the role of government and the nature of innovation in business (Palmer, Oates & Portney 1995).

The implication of this discussion is that a manager's underlying beliefs may influence the extent to which they support energy efficiency initiatives. This means that the way in which energy efficiency improvement is framed to managers by policymakers and energy efficiency practitioners (e.g. as environmental initiatives versus business improvement or productivity initiatives) may influence the extent to which action is taken within firms (Paton 2001). There is also the potential for managers to perceive energy efficiency legislation as a compliance matter, rather than as an opportunity to improve their business performance (Shen, Price & Lu

2012).

Limited incentives

Limited incentives may also play a role in constraining the uptake of energy efficiency projects. Rhodin and Thollander (2006) found that – where a decision to invest in or use energy in a more effective way is perceived a 'hassle' to an individual – then more energy efficient behaviour may be avoided. More significant than 'hassle' is that failure to implement a project successfully might have personal risk to the person responsible. With reference to a data centre, Glanz (2012) explains that – if the data centre fails to operate, then an individual may be at risk of losing their job. Organisational priorities around core business functions may provide a powerful disincentive for individuals and managers to implement energy efficiency initiatives.

Perceptions of responsibility and individual rewards may influence the ways in which employees use energy. Masoso (2010) analysed the energy audits of six buildings in Botswana and South Africa and found that more energy is used during non-working hours than during working hours. The greatest contributors to energy use were found to be air conditioning systems and equipment, such as computers and lights, being left on overnight. Other research has identified a high degree of variability by which tenants interact with control systems of lighting systems (Lindelof & Morel 2006) and office equipment (Jean-Sébastien et al. 2008; Kawamoto, Shimoda & Mizuno 2004).

4.4.1 Limitations of the behavioural perspective

The behavioural perspective expands on the limitations inherent in a neoclassical economic perspective on the barriers to energy efficiency by highlighting that decision-making and action taken on energy efficiency in organisations may be influenced by bounded rationality, personal values and beliefs and limited incentives. However, the behavioural perspective has been criticised because it implies that individuals themselves are a barrier to implementing particularly technologies – an approach still based on notions of rationality; that is, of implementing energy efficiency because it is a cost-saving initiative that supports the profitability of the firm. This notion does not account for the social meanings that may be attributed to action on energy – meanings that are both influenced by and influence cultural practices and shared expectations (Shove et al. 1998). This perspective informs the important need for organisational structures, culture and wider societal influences on the energy efficiency gap to be examined (Breukers et al. 2011; Bye & Bruvoll 2008; Lopes, Antunes & Martins 2012)

Table 4.5 provides a summary of the behavioural perspective. It considers central assumptions, key references, primary levels of analysis and limitations.

Table 4.5: Summary of the behavioural perspective

Aspect	**Description**
Central assumptions	Individual behaviour is influenced by systematic constraints and biases that limit 'rational' decision-making on investments in and use of energy
Key references	Anderson & Newell 2004; Breukers et al. 2011; Bye & Bruvoll 2008; Glanz 2012; Harris, Anderson & Shafron 2000; Lopes, Antunes & Martins 2012; Schleich 2004a; Gynther, Mikkonen & Smits 2011; Sorrell et al. 2004; Sorrell et al. 2000.
Primary level of analysis	The individual level
Limitations	Does not typically account for the range and complexity of broader social processes that may influence individual behaviour

4.5 The organisational perspective on the energy efficiency gap

> *"Dynamic competition is characterized by changing technological opportunities coupled with highly incomplete information, organizational inertia and control problems reflecting the difficulty of aligning individual, group and corporate incentives. Companies have numerous avenues for technological improvement, and limited attention."*
>
> *(Porter & van der Linde 1995, p. 99)*

Research that attempts to explain the energy efficiency gap from neoclassical economic and individual behavioural-level perspectives typically does not attempt to account for the organisational-level characteristics of firms and the influence of those characteristics on the uptake of seemingly profitable energy efficiency projects. Even similar firms in the same sector exhibit different levels of energy efficiency performance (Cooremans 2012; DeCanio & Watkins 1998). While this may be explained to some extent by the underlying beliefs of individual managers, this finding challenges the neoclassical economic view that assumes away such differences and also highlights the limits to behavioural perspectives when they are focused on individual behaviour (Gillingham & Palmer 2013; Paton 2001). The organisational perspective on the energy efficiency gap aims to identify the factors within organisations that limit the uptake of profitable energy efficiency projects.

A study by DeCanio and Watkins (1998) has been influential in highlighting the influence of firm characteristics on energy efficiency performance. The authors compared the energy efficiency performance and firm characteristics of 268 companies that were participants in the U.S. Environmental Protection Authority (EPA) Green Lights program and found a number of firm-level variables that were statistically influential. Variables such as the number of employees, earnings per share, historical rate of growth of industry earnings, expected future earnings growth, price/earnings ratio and location were all found to be statistically significant. Although the analysis did not show causality between each characteristic and firm's performance, the study highlights the relevance of examining firm-level differences as a way of understanding barriers and opportunities to improved energy efficiency performance. Table 4.6 lists the key organisational-level barriers presented in the energy efficiency literature. Each of these barriers are then discussed in the paragraphs that follow. It is important to note that many of these organisational perspectives may relate to a variety of other initiatives beyond energy efficiency; that is, they relate to organisational challenges in general.

Table 4.6: Key energy efficiency barriers from an organisational perspective

Barrier	Description
Organisational structure	Organisational structure influences the level of attention to and priority placed on energy efficiency improvement.
Limited collaboration across organisations	Lack of information sharing and collaboration across functional and professional groups within an organisation may limit the improvement options identified and implemented. This may be exacerbated by 'split incentives' in which the benefits from improvement do not accrue to the group responsible for funding implementation.
Visibility of energy use	In the absence of appropriate monitoring systems, energy use and waste may not be visible to managers.
Routines	Established routines may be difficult to change – even when market forces and other business drivers make existing practices ineffective.
Capability	The skills and knowledge required to improve energy management may not be available within an organisation

Organisational structure

Cebon (1992) compared the energy efficiency performance of two universities and found that organisational structure had an important influence on energy efficiency performance. The first university had formed a centralised energy group that had the authority to improve energy efficiency across all university buildings. This structure was influenced by the availability of a high level of fund and a culture of 'inhouse, centralised facilities management' and outsourcing where sufficient expertise was not available internally. In the second university, responsibility and management of energy efficiency was decentralised (i.e. it was allocated to each faculty). There was limited funding and internal expertise available for energy management at this second university. Cebon found that the university with a centralised structure was more likely to undertake projects that involved major capital expenditure. That university also made more use of external resources, such as government and utility-based energy efficiency programs, to support their aims. The university with the decentralised structure was more likely to undertake low and no-cost initiatives that involved working with energy users to modify their behaviour. This university undertook few projects requiring significant capital expenditure. One external provider that worked with one of the faculties assumed that, because one faculty had implemented successful initiatives, then other faculties would do the same. In reality, however, there was limited communication and experience-sharing across faculty groups on energy efficiency issues.

Cebon's study highlights that the organisation culture, availability of funding and structure of an organisation can influence the type of projects that are identified and implemented; that is, the university with a central, expert group with responsibility for driving energy efficiency implemented more large capital projects than the other university. A contributing factor was their experience in project management and the technical knowledge available within the team. In the second university, responsibility for energy efficiency was dispersed and pushed down to the faculty level. With fewer resources and technical expertise, the response was more focused on low cost projects that involved modifying behaviour. The study highlights that the level of resourcing, availability of skills and structure of an organisation can all help to explain differences in energy efficiency performance. These findings also explain differences in organisational performance more generally. They are not just limited to energy management.

Limited collaboration across functional and professional groups

Information sharing and collaboration across internal groups and departments has been highlighted as a common barrier by a number of researchers. Neoclassical economic perspectives assume that as long as information is available in the market, then it will be used by the managers who require that information. Organisational perspectives highlight how internal professional and functional boundaries can be barriers to the selection of and decisions made on energy efficiency projects.

Drawing on the work of Edgar Schein (1997), Hoffman (2001, p. 135) describes the challenge of working across 'occupational communities', which he defines as "groups of constituents that cut across organizations and share common language, perspectives, and assumptions about the nature of business". These communities vary from firm to firm, but typically include engineering, marketing, health, safety and environment, accounting and finance. Each community has its own incentives, priorities and language, which create barriers to the identification, funding and implementation of energy efficiency projects (Paton 2001).

The need to engage with and work across these 'occupational communities' is illustrated by Cebon (1992) by using the example of an energy efficiency project that involved the installation of energy controls on fume hoods in laboratories. Cebon explains that fume hoods in the laboratories at the university were controlled manually. This meant that they were often left on continuously – even though, for much of the time, these fume hoods were not contributing useful work. A member of the energy team identified an opportunity to install a controller on the fume hoods. The specialist had the technical expertise required to estimate the costs and benefits of the project and also came to understand the specific needs of the users. However, halfway through installation of the fume hoods across the university laboratories the safety officers in the Health and Safety Department became aware of the project for the first time and the installation of the fume hoods were stopped on the basis of safety concerns.

The project highlights the importance of what Cebon calls 'connected information'. Connected information draws on perspectives from individuals and groups across professional and functional boundaries within an organisation. These participants may have a direct interest in the outcome, but they may not be energy users.
In the case of the fume hoods project, the technical/maintenance personnel who had been involved in the approval and installation process had not consulted with the safety officers to obtain their input. As a consequence, the project was discontinued. This provides an insight into the implementation of energy management, suggesting

that greater consultation across the organisation would be useful. However, the research does not inform what difficulties are associated with such consultation, how such communication can be encouraged and the extent to which the wider organisational context may influence how such communications occur. These are all issues that will be examined in the case study developed in this thesis.

Visibility of energy use

Information on energy use and associated financial and other business costs may be 'invisible' to management. Organisations find it challenging to justify investment in energy information systems (e.g. sub-metering), to make energy usage more visible and provide the data required to analyse energy use to identify potential opportunities, prepare a business case proposal and to monitor the outcomes from implemented projects (Rohdin, Thollander & Solding 2007). A lack of information can, in turn, make it difficult for firms to create accountability for energy use. Even in cases where energy efficiency is communicated as an organisational priority and performance targets are set, without the right level of data and appropriate measures, accountability is difficult to enforce (Bor 2008; Pérez-Lombard et al. 2012; Rietbergen & Blok 2010).

Routines

Cooremans (2011) has examined the influence that different investment procedures and routines in firms can have on energy efficiency projects. Investment procedures include the analytic and capital budgeting tools used, profitability requirements, the different steps a project has to follow and whether a particular project is categorised as a capital or operational investment (Russell 2008). Established routines may create inefficiencies if an organisation is unable to modify them in response to market and other forces. Therefore, organisations may continue to apply particular routines that were once efficient, but for which surrounding conditions have changed (Paton 2001).

Capability

The skills and knowledge of personnel within a firm is another important factor. In relation to presenting business case proposals, Cooremans (2011) highlights the importance of framing proposals in terms of the strategic benefits to the organisation.

Proposals may also not account for the full benefits to the organisation. Worrell et al (2003) reviewed 52 publicly available energy efficiency projects. They found that the average payback on those projects could be reduced from 4.2 years to 1.9 years by including productivity and other project benefits, rather than just direct energy-related benefits. The skills, knowledge and experience of personnel involved in energy efficiency can have a significant influence on firm energy efficiency performance (IPCC 2001; Rigby 2005; Russell 2008). These perspectives also challenge the arguments that have been made about hidden costs – an argument that is often made without reference to hidden or unaccounted benefits (Cooremans 2012).

Cooremans (2012) examined decisions on energy efficiency projects in 25 companies in Switzerland. Semi-directive interviews were undertaken with each of the company managers responsible for energy management as well as the most senior finance manager. The research demonstrated that energy efficiency investments that were focused on increasing the productivity of existing means of production were more effective that those that were based on energy cost savings alone. Cooremans contributes a perspective that highlights the extent to which a project is considered 'strategic'. This can have a strong influence on whether the project is selected for funding and implementation. According to Cooremans, the strategic nature of an investment is made up of three components:

1. risk
2. value, and
3. the costs associated with implementation.

The implication is that more 'strategic' energy efficiency projects are more likely to attract investment.

Cooremans (2012) research raises a number of important questions for future research. For example, it is assumed that the strategic nature of an investment is 'known' to decision-makers. However, a project may be considered 'strategic' to an individual, but individual interest may not necessarily align with the organisation's strategic goals. Further, the definition of 'strategic' does not seem to apply for low and no cost projects, which represent a significant opportunity for improving energy efficiency performance in organisations. There is scope to further examine the different influences on decision-making associated with projects and the processes that support such decision-making. This includes the different perceptions of how the term 'strategic' is understood at different levels of an organisation, and how the level at which decisions are taken might influence the extent to which a project is considered to be 'strategic'. Cooremans model also highlights the potential for individual and collective influence in decision making based on 'perceived' value, risk and costs. This presents an important contrast with approaches that assume the evaluation of projects to be an objective phenomenon.

Interactions between barriers

In commercial buildings, building managers are in a unique position to influence energy efficiency performance because they manage the operations of a building on a day-to-day basis. However, the varied level of influence that building managers may have may be explained by the diversity of their experience and skills (IPCC 2001; Marans & Edelstein 2010), the extent to which they are expected by management to act on energy efficiency and the level of remuneration they receive (Aune, Berker & Bye 2009; Lewis, Elmualim & Riley 2011; Yik, Lee & Ng 2002).

This discussion highlights how a number of different barriers to energy efficiency may act to reinforce one another. The interaction amongst barriers can create negative feedback loops that can reinforce organisational barriers and make energy efficiency even more challenging to address (Reyna et al. 2012). This highlights the need for research that examines how such feedback loops occur and the practices that are successful in transforming negative feedback loops into positive ones that encourage rather than create barriers to energy efficiency improvement.

4.5.1 Limitations of the organisational perspective

The organisational perspective helps to explain barriers to energy efficiency improvement that go beyond those identified through individual and market-level analyses conducted from a neoclassical economic and behavioural perspective. While the organisational perspective goes some way to addressing the critique of the behavioural perspective by accounting for organisational-level factors that influence individual and group behaviour on energy efficiency, it does not address wider societal influences, including the influence that stakeholders external to a firm may have on the energy management practices adopted and the energy performance of organisations (Breukers et al. 2011; Lopes et al 2012). The next section considers the influence that external organisational stakeholders may have on barriers to energy efficiency. Table 4.7 provides a summary of the organisational perspective. It considers central assumptions, key references, primary levels of analysis and limitations.

Table 4.7: Summary of the organisational perspective

Aspect	Description
Central assumptions	The priority placed on energy efficiency improvement within an organisation can be influenced by a range of interrelated organisational factors, including structure, collaboration across interorganisational boundaries, information about energy use, existing routines and organisational capability.
Key references	Cooremans 2012; DeCanio & Watkins 1998; Hoffman 2001; Paton 2001; Pérez-Lombard et al. 2012; Rohdin, Thollander & Solding 2007.
Primary level of analysis	The organisational level
Limitations	In the energy efficiency literature, there has been limited consideration of the role and influence of an organisation's external stakeholders and the manner in which the actions of these stakeholders influence energy management practices and performance within organisations.

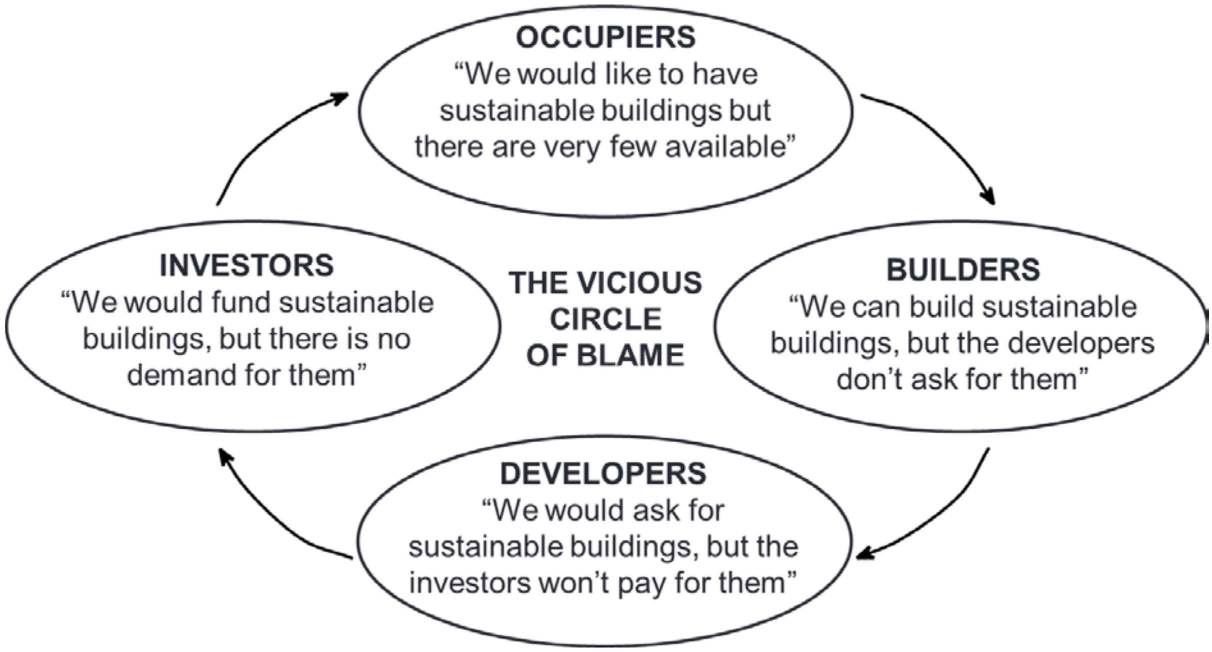
4.6 The interorganisational stakeholder perspective on the energy efficiency gap

Barriers have not typically been framed in the energy efficiency literature from an interorganisational perspective and there has been limited attention placed on the dynamic interactions between organisations and the way in which these dynamics influence the adoption of energy management practices. The following quotation from Biggart and Lutzenhiser (2007, p. 1082) highlights the importance of examining the interactions between multiple organisational stakeholders and the ways in which these interactions influence the energy performance of organisations:

> "Some real successes in improving the energy performance of the commercial and institutional built environment have taken place. But they generally have not come about as a direct result of economic inducements or economic self-interest. They have resulted from the actions of charismatic state and local leaders, pressures from citizen movements, the initiatives of semiautonomous federal agencies, … and highly visible signature building projects by private firms to house their headquarters operations (and contribute to their branding efforts)."

A key question that informs consideration of interorganisational barriers to energy efficiency is: How do organisations interact to establish social norms and standards which influence the energy efficiency performance of organisations? For example, Warren-Myers (2012) examines the interactions amongst stakeholders in the property sector that have an interest in sustainability (an important component of which is energy efficiency). Figure 4.2 illustrates how particular stakeholders may create barriers to others stakeholders. Overall, this can create a situation that has been termed the 'cycle of blame' (Cadman 2000; Warren-Myers 2012).

Figure 4.2: Interactions amongst stakeholders in the commercial sector
(Source: Adapted from Warren-Myers 2012, p. 120)



The purpose in presenting this diagram is to illustrate the way in which the attitudes and actions of a range of organisational stakeholders may influence each other to create barriers to energy efficiency and sustainability (Hoffman 2001; Newell 2008; Sayce, Ellison & Parnell 2007). The drivers for sustainable commercial property, a large component of which is energy efficiency, include government legislation, changing landlord tenant relationships and perceptions of enhanced returns and increased value. These drivers influence changes across a number of different stakeholders, including investors, business, government, tenant and community (Newell 2008). Therefore, the interactions between these organisations can be seen to create barriers to the uptake of energy efficiency projects. The range of stakeholders examined in the literature is presented in Table 4.8.

Table 4.8: Stakeholders with an interest in organisational management of energy

Stakeholder	Key references
Government	Schmidt (2012); Pizer (2008); Palm(2010); IEA (2003); Schmidt (2012); Wiel (2003); Morsink (2011); Bazerman (2008)
Shareholders/investors	Harrison (2011); Warren-Myers (2012); Popescu (2012); Newell (2011); Clark (2005); Hamilton (2011)
Industry associations	Hamilton (2011); Newell (2008); Hoffman (2008)
Customers	Newell (2008); Pellegrini-Masini (2011); Miller (2008); Miller (2009); Hinnells (2008)
Electrical utilities	Croucher (2011a); Levine (1994); Satchwell (2011); Vine (2010)
Researchers	Warren-Myers (2012); Shove (1998)
Consultants	Vine (2005); Painuly (2003); Duplessis (2012); Marino (2011)
Insurance companies	Vine (2000); Mills (2009); Mills (2003)
Non-governmental organisations	Gullberg (2008)

As previously discussed, governments have played a fundamental role in developing policies and programs that are designed to address the energy efficiency gap. This is particularly important where issues are of an immediate and short-term nature to have maximum effect (e.g. slowing the negative impacts of climate change requires significant greenhouse gas emission reductions in the short-term). ‘Business as usual’ approaches are unlikely to be sufficient to address the urgency of the problem (Pizer & Popp 2008; Schmidt et al. 2012).

Various energy efficiency policies were discussed in Chapter 3. Government policies are, however, influenced by the underpinning frameworks and beliefs systems applied by government personnel (IEA 2003; Palm & Thollander 2010), and policies may create unintended consequences or have limited effect (Morsink, Hofman & Lovett 2011; Schmidt et al. 2012; Wiel & McMahon 2003). The internal machinations of bureaucracies and political influences are another variable that can influence the effectiveness of government policies (Bazerman 2008). Government interactions extend to international cooperation, which can reduce costs for the design and testing of more energy efficient equipment and improved opportunities in relation to trade and technology transfer (IEA 2000). A lack of cooperation may also have an influence (e.g. through diverse fiscal and tax incentives across national and regional boundaries (Barla & Proost 2012)).

Policymakers are part of the systems which they seek to influence. In contrast to 'command and control' perspectives, in which policymaking is seen as a task that involves coercing individuals to act in particular ways, policymaking as an activity can be conceptualised as a: "reflexive process of social learning and network building" (Shove, Pantzar & Watson 2012, p. 25). According to this view, policy is developed and implemented through the interactions between government and non-government actors, rather than through the actions of the government alone (Smith, Stirling & Berkhout 2005). An important contribution of system-level analyses is that they can help provide an understanding of the interaction and trade-offs that occur between different policy approaches. In some cases, these may be complementary, but in others, they may lead to unintended outcomes (Grünewald et al. 2012). This discussion reiterates the finding from the previous chapter of the importance of examining how policies interact to influence energy management practices. Such interaction may be between policies themselves as well as through the interactions amongst the many different organisational stakeholders that may be affected by these policies.

Theoretical approaches applied to the interorganisational perspective

There have been a number of recent applications of sociological-based theories and empirical techniques towards understanding the energy efficiency gap from the point of view of the interactions between multiple stakeholders. Verbong and Geels (2010) examined the application of sociotechnical systems in the context of the transition towards renewable energy supplies. They explain that sociotechnical transitions involve interactions between:

1. technical elements, such as generation plants
2. networks of actors and social groups, such as large industrial energy users, and

3. formal, normative and cognitive rules that guide the activities of actors.

The authors argue that it is the interaction between these three elements that encourages ‘lock-in’ to the existing system. Path dependency is another important characteristic that limits the options available as the actions of critical actors combined with existing technology encourage maintenance of the status quo. Co-evolution is also an important consideration in that social systems are changed by technology and technology itself is shaped by society (Geels, Hekkert & Jacobsson 2008; Schot & Geels 2008).

Palm and Thollander (2010) examine the social networks associated with energy efficiency in the Swedish industrial sector. They consider the information sources that practitioners use to access information about energy efficiency finding that the sources of information that are considered to be credible very from one sector to another. The researchers suggest that a reliance on information sourced within a sectoral group may limit the generation of new ideas and potential lock-in to existing energy management practices. They suggest that new sources of information and dialogue with practitioners and experts from outside a particular industry sector may provide an important opportunity to address limited uptake of energy efficiency projects within a particular sector. Palm and Thollander conclude that further examination of social networks can provide an important and unique contribution to the energy efficiency literature.

Biggart and Lutzenhiser (Biggart & Lutzenhiser 2007) argue that economic sociology can provide a useful contribution to understanding energy inefficiency as a social problem. In particular, the authors highlight the opportunity to examine the social structure of the market and the interactions amongst the multiple stakeholders within that market – as a potential contribution that institutional economics and sociology can play in providing new perspectives on the energy efficiency gap and how it can be addressed.

4.6.1 Limitations of the interorganisational perspective

There has been limited empirical work that examines energy efficiency in organisations from the perspective of social theories and networks (Biggart & Lutzenhiser 2007; Thollander & Palm 2013). Shove (Shove 1998) argues that a contributing factor may be the perception by policymakers and others who commission research that sociological approaches do not generate results that can be widely generalised.

This perspective may reinforce preferences amongst those commissioning such research for the use of particular methodologies and approaches (e.g. those who utilise qualitative data or justify outcomes in terms of neoclassical economic frameworks). Further, such research requires a different set of skills than has been traditionally applied to the problem of the energy efficiency gap. As Shove (1998, p. 111) describes:

> "… different sorts of expertise would be needed to map sociotechnical opportunities for energy conservation, evaluate the social transferability of building technology, or figure out how actors might be re-aligned and new techno-economic networks pieced together in the interests of energy efficiency ..."

The interorganisational perspective is not usual within the energy efficiency literature. However, as this concise review has identified, it is an important perspective that may provide novel explanations for the energy efficiency gap and explain the process by which organisations adopt more effective energy management practices. In particular, this perspective can help to address the research gap identified in Chapter 3 in relation to better understanding the effects of multiple energy efficiency policies and the complex interactions between multiple organisational stakeholders that may impact on the effectiveness of energy efficiency policies. Therefore, this is an important perspective to be examined in this research.

Table 4.9 presents a summary of the organisational perspective. It considers central assumptions, key references, primary levels of analysis and limitations.

Table 4.9: Summary of the interorganisational perspective

Aspect	Description
Central assumptions	Organisations interact to establish social norms and standards, which influence the energy performance of organisations.
Key references	Biggart & Lutzenhiser 2007; Hoffman 2001; Palm 2009; Palm & Thollander 2010; Warren-Myers 2012.
Primary level of analysis	The interactions between multiple organisations.
Limitations	Since the interactions are expected to be complex and involve multiple stakeholders this presents some challenges for designing research that informs the action of policymakers.

4.7 Implications for researching energy management practices

In Chapter 3, it was argued that in order to better understand how energy management practices are adopted by organisations, there is a need for research that examines the energy management practices as a dynamic phenomenon. That is, rather than simply examining the extent to which energy management practices are adopted by organisations at a particular point in time, an alternative approach could be to examine the dynamic processes by which new energy management practices develop and are adopted by organisations over time. This perspective reflects the emergent and process-based view of change (Dawson 1997, 2003; Van de Ven 2010) –discussed in Chapter 3 (see 3.3). This chapter has argued that adopting such a view could address knowledge gaps in the energy efficiency literature and provide important insights into the actions that policymakers and practitioners can draw on to accelerate the adoption of effective energy management practices in organisations.

The aim of the present chapter has been to examine the comprehensive literature on the barriers to energy efficiency in organisations in order to identify what is known about barriers, and to inform the selection and development of an appropriate theoretical framework for this research. This review has examined the main barriers to energy efficiency improvement that researchers have identified and the underlying assumptions that inform the identification of these barriers. Three key conclusions can be drawn from the review that have implications for this research:

1. **A focus on energy management practices can address limitations of existing research on barriers to energy efficiency.**

Researchers have identified a number of limitations of the focus on energy efficiency barriers (Shove et al. 1998; Sorrell 2004; Trianni & Cagno 2012). This body of research has enabled a comprehensive list of barriers to be developed (as presented in this literature review). However, for researchers, policymakers and practitioners, this presents a challenge. For example, it has been acknowledged that these barriers are defined in different ways and are difficult to compare (Sorrell, 2011). As Sorrell, Mallett & Nye (2011, p. vii) lament:

> "The concept of a barrier to energy efficiency is both confused and contested. Although the term is widely used, there is little consensus on how barriers should be understood, how important they are in different contexts, and how (if at all) they should be addressed."

Other limitations of the barriers approach include that barriers are not directly observable (Weber 1997) and where it is assumed that barriers are not interlinked, then there is a tendency for empirical research to adopt a reductionist perspective (Palm & Thollander 2010). This finding further reinforces the relevance of the focus in this research on effective energy management practices – an area that has received much less attention in the literature than the 'barriers' to energy efficiency reviewed in this chapter. A focus on successful practices can likely provide both theoretical and practical insights that may not be obtained through a focus on barriers.

2. **There is a need for research that examines the dynamics of change in an energy efficiency context.**

This chapter has further reinforced the need for research that examines the dynamic nature of change, both in terms of the readiness and capability of energy consuming organisations and the changing interests of external stakeholders in the energy performance of organisations. There is currently limited examination or appreciation evident within the existing energy efficiency literature of the dynamics associated with changing energy management practices in organisations over time.

3. **There is a need for a more integrated model to examine changing energy management practices.**

Understanding of the energy efficiency gap and the actions that can be taken to resolve it are linked to the underlying assumptions that inform the research conducted (Biggart & Lutzenhiser 2007; Shove 1998). Whilst there are advantages to having a broad range of theoretical perspectives, this approach can present a piecemeal view of the phenomenon of the energy efficiency gap and the potential solutions that could be applied to address it. This review has highlighted the need for theoretical approaches that are able to provide a more holistic and integrated perspective on the energy efficiency gap and the energy management practices practitioners and policymakers adopt to address it. The early work that has been conducted in applying sociological theories at the interorganisational level shows significant promise in providing new and important insights into the reasons for and actions that can be taken to address the energy efficiency gap. An important contribution to the literature could be made by building on the early work at the interorganisational level, while also developing a theoretical model that supports a more holistic and integrated consideration of the energy efficiency gap and the energy management practices that can be applied within firms to accelerate energy efficiency improvement. Such a model should support comparison across multiple levels of analysis and account for the wider social context that influences energy management practices.

4.8 Summary and conclusions

To better understand the role that improved energy management practices can play in resolving the gap between actual and optimal energy use in businesses, this chapter has drawn on the existing literature which explains the barriers that limit the uptake of seemingly cost-effective energy efficiency projects. The aim of this chapter has been to inform the research design by reviewing the range of theoretical perspectives applied by researchers in seeking to understand the energy efficiency gap. The literature review has been structured into four categories to support examination of both the disciplinary perspectives and the typical levels of analysis adopted. This approach highlights the need for the development of integrated models to analyse changing energy management practices. Such a model should be multidisciplinary and examine the process of change over time at multiple levels. Further, research that examines energy management practices as a process of change over time can provide a more dynamic and comprehensive perspective that will generate new knowledge to inform the actions that policymakers and practitioners take to accelerate the uptake of effective energy management practices. Chapter 5 draws on contemporary perspectives in institutional theory to develop the theoretical framework that will be applied in this thesis.

5. A framework to examine changing energy management practices

5.1 Introduction

Chapter 5 aims to develop the theoretical framework that will support empirical research to respond to the research question: *How* and *why* do energy management practices change? The previous chapters explained that in order to contribute to our understanding of the way in which organisations develop and adopt energy management practices, the theoretical framework should:

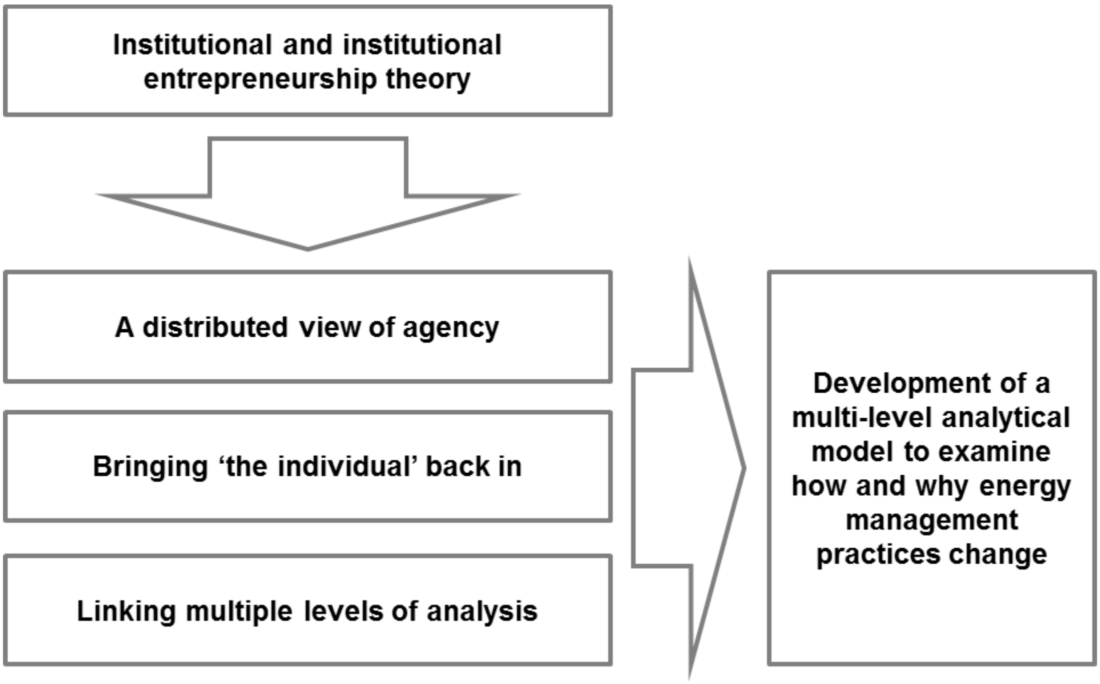
- support analysis at multiple levels from individual decision-making through to the wider social context within which organisations operate
- expose the skills and strategies of individuals as they attempt to influence changes in energy management practices
- account for the interaction between multiple stakeholders as they influence change, and
- examine the dynamic process of change over time.

This chapter argues that contemporary developments in institutional theory provide a basis for the development of an appropriate theoretical framework. At the same time, research examining *how* and *why* energy management practices change can provide insights into the process by which multiple actors interact to create institutional change, thus contributing to the institutional theory and institutional entrepreneurship literatures.

Chapter 5 begins by exploring the foundations of institutional theory, including key concepts and definitions. The challenges associated with establishing a theory of action within institutional theory are then explored and approaches to explaining institutional change are examined. Finally, three contemporary concepts that inform development of the multi-level analytical model that is used in this thesis are described. These concepts are:

1. a distributed view of agency
2. bringing micro-processes and the individual into institutional analysis, and
3. linking individual and field-level analyses (see Figure 5.1).

Figure 5.1: Development of the theoretical framework for this study



5.2 Core features of institutional theory

Institutional theory provides a powerful approach to explain individual and organisational action (Dacin, Goodstein & Scott 2002; Greenwood et al. 2008). The core idea of institutional theory is that organisations are open systems that are deeply embedded in the social environments in which they operate (DiMaggio & Powell 1983; North 1990; Scott 2001; Suddaby 2010a). Individual and organisational behaviour is considered to be influenced by institutions, which are social structures that are: "composed of cultural-cognitive, normative, and regulative elements that … provide stability and meaning to social life" (Scott 2008, p. 48). Recent research has examined the formation of institutions around issues such as environmental protection (Hoffman 1999) and the development of new management practices (Lounsbury & Crumley 2007; Perkmann & Spicer 2008; Reay, Golden-Biddle & Germann 2006).

Institutions influence behaviour as individuals and organisations strive for legitimacy. Legitimacy is broadly defined as the "generalised perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman 1995, p. 574). Institutions act as taken-for-granted social facts that are culturally embedded (Wooten & Hoffman 2008), much like rules of a game (Kraatz & Block 2008; North 1990).

Institutional elements

Institutional theory contrasts with rationalist theories of individual and organisational behaviour in that the behaviour of individuals and organisations are attributed to the social context that they operate within, rather than the characteristics or motives of individuals or organisations operating in isolation (Biggart & Lutzenhiser 2007; DiMaggio & Powell 1991; Schneiberg & Clemens 2006; Suddaby et al. 2010). The predominance of such perspectives and their narrow focus on rationality, efficiency and coercive mechanisms may limit our ability to solve challenging social issues. This has influenced calls from some researchers to use institutional theory as a means to provide new perspectives on the many persistent social issues faced by contemporary society (Hoffman 2001; Kraatz 2011; Scott 2010; Stern & Barley 1996). As Chapter 2 highlights, the phenomenon of the energy efficiency gap and the challenge of accelerating the adoption of energy management practices are social issues that can benefit from new perspectives on both causes and solutions (Biggart & Lutzenhiser 2007; Palm & Thollander 2010; Shove 1998).

Institutions are widely considered to be composed of three central pillars or institutional elements:

1. cognitive institutional elements
2. normative institutional elements, and
3. regulative institutional elements.

These institutional elements are considered to act in combination as they influence social order, although the relative influence of each may vary according to the social context and situation (Scott 2010).

‘Cognitive’ institutional elements are the understandings that individuals and organisations have of reality and the frames of reference that are used to create meaning (Hoffman 2001). Cognitive assumptions are often reflected in the ‘taken-for-granted’ actions that are considered ‘right and natural’ (Zietsma & McKnight 2009). Cognitive assumptions may be unconscious, automatic and unquestioned (Maguire, Hardy & Lawrence 2004). Cognitive institutional elements relevant to energy management practices include the way in which various individuals and organisations understand the drivers for and benefits of energy efficiency.

‘Normative’ institutional elements guide individual and organisational behaviour through the influence of values, ethics, morality, norms, role expectations, authority systems, duty and codes of conduct (Scott 2010). Rather than financial or other instrumental outcomes, actors are considered to be influenced by their need to be part of social groups (Geels 2004). Normative elements influence actors by defining appropriate and expected behaviour in a certain social situation (Wicks 2001). March and Olsen (2006) suggest that normative social influences act as a “logic of appropriateness” that inform the question: What is required of a person like me in a situation like this? In relation to energy management, individual and organisational actors may refer to and be influenced by the behaviour of their peers and other actors. However, it is unclear to what extent normative influences might affect energy management practices and the extent to which cognitive and regulatory institutional elements are also influential.

‘Regulatory’ institutional elements influence organisational behaviour through formal rules and incentives (Strang & Sine 2000) that are developed by actors who have the authority to enforce conformity and deliver sanctions where deviation occurs (Scott 2001). The most common regulatory institutional elements are laws established and enforced by the State. Other institutional elements include industry standards (Hoffman 1999) and industry-enforced codes of conduct, certification and labelling schemes (Gale 2004).

Institutional theory has predominantly focused on explaining why organisations operating in different environments are often similar in structure (Barley & Tolbert 1997; Battilana, Leca & Boxenbaum 2009; DiMaggio 1988; Lawrence, Winn &

Jennings 2001; Tolbert & Zucker 1994). Institutional elements have been examined for their influence on social stability which is manifest in the tendency towards isomorphic (i.e. similar) organisational structures across organisational populations. From this perspective, institutional elements tend to be viewed as constraining behaviour – limiting the options available to individual and organisational actors and encouraging the reproduction of institutions (Reay, Golden-Biddle & Germann 2006). However, over the past decade, there has been a strong focus on explaining how and why institutions change (Battilana, Leca & Boxenbaum 2009; DiMaggio 1988; Maguire, Hardy & Lawrence 2004; Weik 2011) and a body of work has developed around the notion of institutional entrepreneurs who act as: “change agents who actively participate in the implementation of changes that diverge from existing institutions” (Battilana, Leca & Boxenbaum 2009, p. 70). Central to the study of both stability and change within institutional theory is the notion of the organisational field.

The organisational field

Organisational fields are socially constructed through the interaction of people and organisations. This leads to the creation of local social orders which both enable and constrain individual and organisational behaviour (Fligstein 2001). Institutional analyses commonly focus at the level of the organisational field which is made up of: “a community of disparate organizations, including producers, consumers, overseers, and advisors, that engage in common activities, subject to similar reputational and regulatory pressures” (Powell 2007). The field concept has been applied across a wide variety of settings within the social sciences. As DiMaggio and Powell (1983, p. 148) explain: “the virtue of this unit of analysis is that it directs our attention not simply to competing firms, or to networks of organisations that actually interact, but to the totality of relevant actors”. One reason that a focus on organisational fields is a valuable level of analysis is that: “the transfer of ideas, practices, and organizational forms span the boundaries of organizations, industries, and nations” (Powell & Colyvas 2008, p. 276).

Cognitive, normative and regulatory institutional elements are considered to influence individual and firm behaviour at a number of interconnected levels, including the world system, society, organisational field, organisational population, organisation and organisational subsystem (Scott 2001). Thus, organisational fields are conceptualised as being nested within larger systems (Holm 1995). Another important aspect of organisational fields is that they are not clearly delineated from one another (Seo & Creed 2002). Thus, the field concept provides an important link between studies of organisations and wider macro-structures, such as societal systems (Reay & Hinings 2005; Scott 2010).

Each of the levels mentioned so far have not received the same degree of attention. Researchers have called for greater attention to the individual or micro level since institutions are: "reproduced through the everyday activities of individuals" (Powell & Colyvas 2008, p. 277). A focus on individual and organisational practices can provide important insights into the way in which institutions are created, maintained and disrupted (Lawrence et al. 2006). Consideration of the activities at the organisational level can also inform the way in which practices change and spread across populations of organisations and industry sectors at the field level (Hoffman 2001). Institutional analysis conducted at multiple levels can provide useful insights into the strategies that people and organisations use to influence the evolution of social practices, and to evaluate the effectiveness of these strategies and the factors that may influence them (Lawrence, Suddaby & Leca 2011).

DiMaggio (1988) proposes four stages of organisational field development:

1. There is an increase in the interaction of organisations in a particular field.
2. Interorganisational dynamics emerge and create patterns of domination and coalition.
3. There is an increase in the information load that organisations in the field must attend to.
4. Mutual awareness develops amongst organisations in the field.

In early research, organisational fields were traditionally conceptualised as static; that is, researchers assumed that the institutional mechanisms would discourage people and organisations to change. Behaviour was seen to be influenced by social scripts that were, in effect, handed to people and organisations through the social environment that they operated within and over which they had no power to change (Wooten & Hoffman 2008). However, over the past decade, there has been a strong focus on explaining how and why institutions change (Battilana, Leca & Boxenbaum

2009). These recent understandings of institutional entrepreneurship and change are examined in the next section.

5.3 Recent understandings of institutional entrepreneurship and change

> *"New institutions arise when organized actors with sufficient resources (institutional entrepreneurs) see in them an opportunity to realize interests that they value highly."*
>
> *Interest and Agency in Institutional Theory*
>
> *(DiMaggio 1988, p. 14)*

As institutional theorists have placed more focus on understanding institutional change, they have been forced to address the structure–agency dilemma (Garud & Karnoe 2004) which is commonly referred to as the: "paradox of embedded agency" (Dorado 2005; Holm 1995; Seo & Creed 2002). The theoretical challenge arises because actors are considered to be embedded within social structures. This means that the intentions, actions and rationality of individuals and organisations are, effectively, conditioned by institutions (Holm 2005). Since they are embedded in social processes the question arises: How then are these actors able to effect change? (Battilana, Leca & Boxenbaum 2009; Czarniawska 2009; Seo & Creed 2002).

Institutional studies that have focused on understanding isomorphism and stability tend to assume that change would only occur through external jolts and shocks that originate exogenously; that is, from outside an organisational field. These forces, such as changes in technology, regulations and major economic shifts, have been considered to create disturbances in the organisational field leading to change at the organisational level (Barley & Tolbert 1997). Therefore, actors 'within the organisational field' have to respond to such changes. Under these circumstances, the focus on actors within the field is seen as one of adapting to the change, rather than being influential in creating the change itself (Hargrave & Van De Ven 2006).

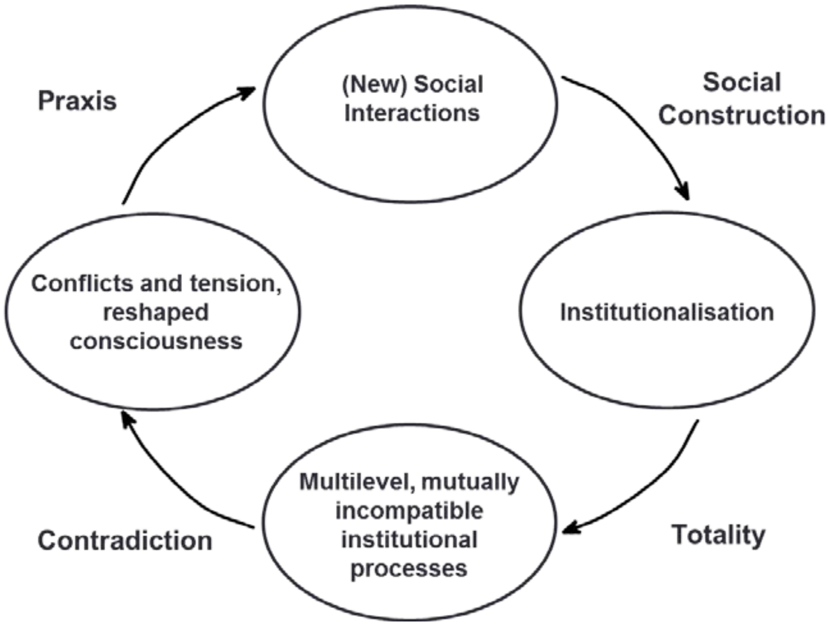
In response to this view in which individuals and organisations are seen to be powerless against social forces, DiMaggio (1988) introduced the notion of the institutional entrepreneur. Institutional entrepreneurs are people and organisations that are able to access resources and apply them in ways that transform existing institutions or create new ones (Battilana, Leca & Boxenbaum 2009; DiMaggio 1988; Garud, Hardy & Maguire 2007). Battilana, Leca & Boxenbaum (2009, p. 68) argue that institutional entrepreneurs act as change agents, yet not all change agents may be considered to be institutional entrepreneurs. The authors propose that to be considered institutional entrepreneurs people and/or organisations must: "(1) initiate divergent changes; and (2) actively participate in the implementation of these changes." Battilana, Leca and Boxenbaum (2009, p. 69) suggest that:

> "Non-divergent changes are aligned with the institutions in a field, while divergent changes break with them. Only when the changes introduced are divergent with reference to the institutional environment in which they are embedded do change agents qualify as institutional entrepreneurs."

It is useful to examine recent explanations for institutional change. For example, dialectical perspectives highlight the influence of political processes within fields themselves that, through political contestation and conflict, may lead to change. Drawing on Benson (1977), Seo and Creed (2002) describe the process of institutional change as a dialectical process occurring in four phases (Figure 5.2):

1. *Social construction*: This involves human interaction directed by people's interests and power. The process leads to the establishment and reproduction of institutional arrangements.
2. *Totality*: Since social structures are interconnected and operate at multiple levels, loose coupling leads to divergence within the interconnected system.
3. *Contradiction*: Inconsistencies amongst the social arrangements lead to ongoing social construction and complex contradictions in the social system.
4. *Praxis*: Social patterns are reconstructed through praxis which Benson (Benson 1977, p. 5) defines as: "the free and creative reconstruction of social arrangements on the basis of a reasoned analysis of both the limits and potentials of present social forms".

Figure 5.2: A dialectical model of institutional change
(Source: Seo & Creed 2002, p. 225)



The dialectical perspective has led to the metaphorical description of organisational fields as a battlefield (DiMaggio & Powell 1983; Reay & Hinings 2005) and the process of change as: “institutional war” (Hoffman 1999).

A contrasting view is that there may also be high levels of collaboration within institutional fields. For example, Lawrence, Hardy & Phillips (2002) observed such collaboration amongst non-governmental organisations (NGOs), academic and government organisations in the organisational field associated with efforts to improve child nutrition in Palestine. This ‘softer’ view of political action within an organisational field is less developed than the ‘battlefield’ perspective, yet presents important questions about what conditions may influence the level of conflict, contestation and collaboration within a particular institutional field. These issues are also of relevance to the way in which energy management practices change and provide an important focus for the research presented in this thesis.

Another emerging perspective on institutional change is the notion of ‘performativity’ which is derived from practice-based perspectives in the social sciences. Performances are: “the specific actions taken by specific people at specific times when they are engaged in an organizational routine" (Feldman 2003, p. 102). Even where there are detailed prescriptions available to an actor, variation may occur as they interpret those prescriptions which lead to variation in performance (Feldman 2003). Performative-driven change may be accomplished by skilled actors (Fligstein 2001) who rely on practical–evaluative agency (Emirbayer & Mische 1998) in order to determine improved ways of doing things to conduct a particular task or to adapt their actions to meet the requirements of different audiences (Lounsbury & Crumley 2007). Conceptually, although such practices may be influenced by the social context within which they occur, they are not considered to be directly *determined* by institutional rules (Lounsbury & Ventresca 2003).

The degree of embeddedness of actors also provides an explanation for institutional change. As mentioned earlier, 'embeddedness' refers to: "the degree to which actors and their actions are linked to their social context" (Reay, Golden-Biddle & Germann 2006, p. 978). Reay (2006) describes three ways in which actors with a low degree of embeddedness might be encouraged to effect institutional change:

1. New actors may enter an institutional context that has already been established. Such actors are less likely to be constrained by the current practices and they may bring new ways of working.
2. Actors at the periphery of fields may play an important role in instigating change.
3. In new and emerging fields the 'rules of the game' may not have been well established. This provides an opportunity for actors to establish the social rules as the field develops.

Embedded agency has traditionally been presented in the literature as a constraint on action. However, Reay (2006) proposes an alternative view by suggesting that embedded actors have particular knowledge and experience within a field and they may *use* their embeddedness to identify opportunities for change that less embedded actors may not be able to identify.

As well as the experience and knowledge of actors suggested by Reay (2006) the level of skill that an individual or organisation has to create institutional change may also influence the potential for and success of institutional entrepreneurs. Fligstein introduced the term 'social skill', which he defines as: "the ability to engage others in collective action" (2001, p. 105). According to Fligstein and McAdam (2011), actors are always using social skills and acting strategically, even within relatively stable fields. Social skills include: "reading people and environments, framing lines of action, and mobilizing people in the service of these action frames" (Fligstein & McAdam 2011, p. 7). Lawrence, Suddaby and Leca use the term 'institutional work' to describe: "the practices of individual and collective actors aimed at creating, maintaining, and disrupting institutions" (Lawrence, Suddaby & Leca 2011 p.52). There does not appear to be a clear distinction between the terms or concepts of 'social skills' and 'institutional work'. Both concepts encourage researchers to focus on the actions that people and organisations take to influence institutions, whereas more traditional institutional studies have typically focused on the effect that institutions have on actors. This contrast in perspectives is relevant to framing the research presented in this thesis, which aims to understand how people and organisations change 'taken-for-granted' social rules associated with energy management practices. It looks to understand what actions individuals and organisations are subject to and what actions are taken by individuals and organisations that are successful in changing the established 'way of doing' energy management. It is expected that exploring the role of corporate energy practitioners may provide important insights into the social skills that are effective in influencing institutional change.

Battilana (2006) proposed that an individual's position in an organisational field may influence their level of embeddedness and the extent to which they are likely to act as institutional entrepreneurs. She presents three factors related to an individual's position in an organisation that may influence the likelihood that they effect change:

1. informal position
2. formal position, and
3. tenure in position.

An individual's position in the organisational field is also presented as an influencing factor (e.g. the status of the organisation they work for, the status of their social group and interorganisational mobility).

This section of the chapter concludes by describing a typology of institutional change that was developed by Hargrave and Van de Ven (2006) – with the aim of providing greater integration to the literature on institutional entrepreneurship and change and to focus future research. Before examining their model, it is useful to review the meaning of 'institutions'. Hargrave and Van de Ven (2006, p. 966) define institutions as: "the humanly devised schemas, norms, and regulations that enable and constrain the behaviour of social actors and make social life predictable and meaningful". The key research questions examined by each of the four models presented by Hargrave and Van de Ven are presented in Table 5.1. Each of the four models is then briefly described.

Table 5.1: Key questions examined in four distinct models of institutional change

Perspective	Question
Institutional Adaptation	• How do individual organisations adapt to their institutional environment? • Why do organisations adopt similar institutions?
Institutional Diffusion	• How do institutions reproduce, diffuse or decline in a population or organisational field? • Why are so many organisations alike?
Institutional Design	• What actions and roles do individual actors undertake to create or change an institutional arrangement?
Collective Action	• How do institutions emerge to facilitate or constrain social movements or technological innovations?

(Source: Hargrave & Van De Ven 2006, p. 867)

The Institutional Adaptation model focuses on understanding how and why organisations conform to forces in the institutional environment. Actors are seen to be responding to change, rather than creating change. Researchers seek to explain how the institutional environment shapes organisational structure and the actions of organisational actors. The Institutional Diffusion model seeks to explain the spread of institutions across organisational populations. This includes consideration of how and why specific institutional arrangements are adopted and retained by actors. The Institutional Adaptation and Institutional Diffusion models reflect a more traditional approach to change in that individuals and organisations are considered to be socialised by institutions and they have limited or no agency to effect change. Their responses are strongly influenced by the social context within which they operate.

The Institutional Design model places a strong focus on institutional entrepreneurs as actors who aim to influence their social context in order to meet predetermined aims. Institutional arrangements reflect the intentional nature of actors as they seek to change the social 'rules of the game' in order to achieve their own ends.

The final model proposed in Hargrave & Van de Ven's typology is the Collective Action model. Collective actions are defined as: "emerging from a dialectical process in which opposing actors in the organizational field frame issues and construct networks in an attempt to introduce new institutional arrangements" (2006, p. 865). This includes the construction of new institutions through the political behaviour of actors as they interact with others as organisational fields emerge. The dialectical aspect of the model suggests that confrontations amongst actors lead to change. Hargrave & Van de Ven (2006) suggest that the Collective Action model is the least developed of the four models. Research that examines collective action can contribute an improved understanding of institutional entrepreneurship and change. Chapter 3 highlighted the complex range of organisational actors that may influence the energy management practices that organisations adopt. Thus, energy management is an appropriate topic to further develop the Collective Action model of institutional change. The potential is examined further as the next section describes a central aspect of the Collective Action model; that is, the notion of distributed agency.

5.4 Adopting a distributed view of agency

Since the notion of institutional entrepreneurship was first introduced by Di Maggio (1988) the depiction of actors as socially determined 'cultural dopes' (at one extreme) and as heroic actors able to overcome institutional pressure with relative ease (at the other extreme) has been widely criticised by institutional theorists (Fligstein 2001; Powell & Colyvas 2008; Suddaby 2010b). This has led to an emerging focus on models of institutional change that more effectively account for the involvement of multiple actors who influence each other as part of the process of change. A focus on distributed agency can support the development of new perspectives on the nature of organisational fields and the processes by which institutions are developed, maintained and transformed (Battilana & D'Aunno 2009; Lawrence, Suddaby & Leca 2011).

The notion of distributed agency is that institutional change occurs through the interactions of a number of different actors (Lawrence, Suddaby & Leca 2011). These actors may be distributed across: “multiple dimensions including space, status and time” (Lounsbury & Crumley 2007, p. 1007). The activities of these actors and their influence on each other may limit the options available to other actors within a field over time, creating path dependency (Garud & Karnøe 2003; Schneiberg 2007; Zilber 2012). Actors may behave intentionally, through institutional work, which describes: “the purposive action of individuals and organizations aimed at creating, maintaining and disrupting institutions” (Lawrence & Suddaby 2006, p. 215). Actors may also influence institutional development without specific intentions to alter existing institutional arrangements (Dorado 2005; Zietsma & McKnight 2009). A distributed approach to agency can highlight: “political action among distributed, partisan, and embedded actors” (Hargrave & Van De Ven 2006, p. 882) – addressing an under-theorised aspect of institutional theory associated with depictions of actors and the power and politics that lead to institutional change (Clegg 2010; Wooten & Hoffman 2008).

Another advantage of adopting a distributed view of agency is that consideration of the work of multiple actors can help to address significant gaps in the literature associated with the: “processes by which new institutional innovations emerge, compete, and resolve into shared logics and practices over time” (Zietsma & McKnight 2009, p. 3496). The notion of distributed agency provides an opportunity for researchers to examine:

- the efforts of individual actors in creating institutional change
- the way in which individual contributions combine
- the response that actors have to each other, and
- how the overall contribution of these actors leads to institutional change and stability (Garud & Karnøe 2003; Lawrence, Suddaby & Leca 2011).

Garud & Karnoe (2003) suggest that, despite limited attention to distributed agency within the institutional entrepreneurship literature, the notion is widely acknowledged and theorised within the social construction of technological systems (SCOTS) literature. That is, technological development is considered to involve multiple actors with specialisations that collectively contribute towards achieving technological progress (Garud & Karnøe 2003). However, it is only relatively recently that the distributed view of agency has been explored within the institutional entrepreneurship literature (Battilana, Leca & Boxenbaum 2009).

Garud and Karnøe (2003) aim to connect the SCOTS and institutional entrepreneurship literature in a study that compares the technological development of wind turbines in Denmark and the United States. They observed that the actions of institutional actors in each country had a strong influence on the technological outcomes that were achieved. The authors used the term 'bricolage' to describe the approach in Denmark, in that there was a high level of: "resourcefulness and improvisation on the part of the involved actors" (Garud & Karnøe 2003, p. 278). In contrast, the approach in the United States was based on a strong and confident vision of success in which efforts were primarily focused on attempts to leapfrog existing technology. The actors' confidence and belief that they would achieve a breakthrough in the United States led to the expectation amongst the actors involved that 'technological breakthroughs' would be achieved by solving engineering problems quickly and dramatically. When that was not achieved in the United States, progress stalled. In contrast, a continuous improvement approach in Denmark contributed to ongoing progress and development.

Garud and Karnoe (2003) suggest that the composition of the organisational fields that formed in each country, the cultural expectations and approach of those involved and the interactions between actors within each technological field helped to explain why the Danish wind turbine industry was more successful than the United States wind turbine industry. An important point of difference with the approach adopted in the SCOTS literature was that – in addition to actors being distributed over geographical locations – they were also embedded in the technological paths that they attempted to shape. The interaction between distributed actors suggests that path dependency is created. This limits the choices available to actors in the field. The higher level of adaptability and cooperation amongst actors in the Danish case, allowed for greater adaptation than was available to actors in the United States case.

With regard to the application of distributed agency as it relates to the emergence and adoption of new management practices, Perkmann and Spicer (2008) conducted a literature review to identify empirical studies that examined the role and institutional work of actors attempting to institutionalise management ‘fashions’ such as Total Quality Management, quality circles and business process reengineering. They found that many studies had a focus on one dominant actor. For example:

- Baron, Dobbin & Jennings (1986) emphasised the role and influence of trade unions on human resource management practices
- David and Strang (2006) and Giroux (2006) focused on consultants and gurus in considering the refinement and promotion of management practices associated with Total Quality Management, and
- Benders, Berg and Bijsterveld (1998) focused on the role of consultants in relation to Business Process Engineering.

In contrast, a few other studies examined the interaction amongst multiple and distributed actors. For example:

- Hoffman’s (1999) study of environmental practices in the United States considered the roles of the state and NGOs as well as large for-profit organisations.
- Orsato, Hond & Clegg (2002) examined the interaction between the government, industry associations and industry participants in the development of recycling in the European automotive industry.
- Botzem & Quack’s (2006) work on financial reporting practices included consideration of the roles, influence and activities of professional bodies, governmental bodies and international NGOs.

In reviewing these studies Perkmann and Spicer (2008) have suggested that management fashions are more likely to become embedded within organisations when there are a number of diverse institutional actors involved, and when those actors use different skills and strategies to change the institutions that they are subject to. Their paper concluded with suggestions about a number of key research gaps in the institutional entrepreneurship literature that are associated with the development of management practices. The authors highlight the need for more careful examination of the sequencing of the types of activities that bring about institutional change. The research presented in this thesis will examine the process by which energy management practices change over time, thus addressing the need for a better understanding of the way in which actors influence institutional change and the sequence by which change occurs over time.

The Garud and Karnoe (2003) and Perkmann and Spicer (2008) studies have provided important insights into key considerations and research gaps associated with adopting a distributed view of agency. Three additional empirical studies by Lawrence, Hardy and Phillips (2002), Reay and Hinings (2005) and Zietsma and McKnight (2009) are considered here with specific reference to the insights on the role that distributed actors play in relation to the emergence, reconstitution and evolution of institutions and institutional fields. Relevant points from each of these studies are summarised in Table 5.2.

Table 5.2: Key insights from empirical studies considering distributed agency

Research setting	Key actors	Insights regarding distributed agency and institutional change
Lawrence, Hardy & Phillips 2002		
Explored the growing influence of a small NGO in the field of child nutrition	• NGOs • Academic institutions • Government Ministry of Health	Collaboration between actors becomes a source of change that allows less powerful actors to effect institutional change
Reay & Hinings 2005		
Examined the reconstitution of the health care field in Alberta, Canada following the introduction of major structural change by the regional government	• Suppliers • Resource and product consumers • Regulatory agencies • Organisations producing similar services and products	Change was primarily driven by one powerful actor (the provincial government), but the study identified the interdependencies and influence across actors in the field as it was reconstituted following a radical change initiative
Zietsma & McKnight 2009		
Examined the institutional work of diverse actors involved in defining a sustainable forest management standard	• Activists • Industry associations • Regional government • Elite organisational field members	Observed institutional development as a process of co-creation, involving both collaboration and competition Institutional disruption, creation and maintenance work occurs concurrently and iteratively

Lawrence, Hardy and Phillips (2002) observed the activities of an NGO as it enhanced its position from being viewed as an organisation with limited influence to one that was considered a regional expert in child nutrition. The study demonstrates that even small organisations with limited influence and power may be able to effect institutional change through collaboration with others – particularly where the collaboration involves partners that are able to share their specific expertise and knowledge to achieve a shared objective. From a methodological perspective, the study highlights the value of deep, qualitative approaches that allow for insights into institutional development that are unlikely to emerge through large-scale qualitative studies.

In contrast to the study of small organisations with limited power influencing the development of institutions, Reay and Hinings (2005) examined the interactions amongst a range of different actors involved in the re-composition of the organisational field associated with health care following a large-scale, government-led health reform initiative in Canada. Although the state organisation was a powerful actor, an important contribution from this study was the balanced focus on the relationships between actors within the field and the structure of the field itself. The key propositions from the study were that:

- radical change requires change to field structure as well as the dominant institutional logic in the field
- actors in the field must consistently use their power to drive change
- organisational logics may continue to influence field-level activities – even after a new dominant logic is introduced, and
- key actors respond to change according to their power to take action and the degree to which their interests are aligned to the new institutional logic.

The authors concluded the study with a call for these propositions to be tested in other sectors and circumstances.

Zietsma and McKnight (2009) have presented a more complex view of an organisational field in their study of the emergence of sustainable forestry management practices in Canada. They examined the institutional work of an array of diverse actors involved in defining a widely accepted standard to define sustainable forest management. The authors describe two primary mechanisms for the co-creation mechanisms:

1. collaborative co-creation, which involves adjustments to the proto-institutions that are put forward on the basis of feedback from potential supporters, and
2. competitive convergence, which involves responding to feedback from potential adopters as well as the creators of other proto-institutions.

In concluding the paper, Zietsma and McKnight suggest that the: "co-creation process by multiple actors of different types is much more common than the current literature suggests" (p. 4011). Their study, together with the others considered in this section has important implications for further research that is focused on distributed agency as a means of contributing to our understanding of institutional dynamics.

5.4.1 Section summary

This section of Chapter 5 has introduced the notion of distributed agency as a means of developing a more normative view of agency within the institutional entrepreneurship literature. Key studies that have adopted a distributed perspective of agency have also been reviewed. The Garud & Karnoe (2003) study plays an important role in linking concepts from the SCOTS literature to the institutional entrepreneurship literature by highlighting the impact that actors distributed within a field can have on the technological outcomes achieved. In particular, their study has highlighted the embedded nature of actors and the way in which their interactions can create path dependency and both constrain and provide opportunities for actors in a particular field. Perkmann and Spicer (2008) have suggested that – for management practices to be institutionalised – the involvement of a number of different actors and the diversity of the institutional work that they conduct can have an important influence on the extent to which new management practices become institutionalised. The studies by Lawrence, Hardy and Phillips (2002) and Reay and Hinings (2005) raise important questions about the extent to which distributed actors may collaborate or compete through the process of institutional emergence and re-establishment. Finally, Zietsma & McKnight's (2009) study of the emergence of proto-institutions around sustainable forest practices challenges established linear perspectives of institutional development by demonstrating the non-linear, co-creation of institutions within a field in which actors are involved in a range of political activities that involve both collaboration and competition.

These studies demonstrate the value of adopting a distributed agency perspective in undertaking institutional research. They also raise a number of relevant research questions that correspond with the research questions that have emerged from the energy efficiency literature review. These are:

- Who are the stakeholders that influence energy management practices and how do they effect change?
- How do corporate personnel with responsibility for energy efficiency improvement (referred to as corporate energy practitioners in this thesis) influence the development and adoption of energy management practices?
- What are the triggers that precipitate changes in energy management practices?

The next section reviews the literature in two distinct, yet interrelated areas to provide further perspectives on these questions. The first relates to the call from researchers to 'bring people back in' by examining the role and activities of individuals involved in institutional change. The second area highlights the links between individual, organisations and the field throughout the process of institutional change.

5.5 Bringing micro processes and the individual into institutional analyses

Earlier, this chapter highlighted that the organisational field is a valuable level of analysis because it allows for change to be examined in a manner that spans organisations as well as industries and even nations (DiMaggio & Powell 1983; Powell 2007). This broad level of analysis may be considered the 'macro level'. This has meant that theory has tended to focus on momentous events at the organisational field, industry and national level without considering the involvement and influence of everyday processes and the powerful role that individuals may play in maintaining social order (Powell 2007).

In contrast, researchers have increasingly called for a greater focus on individuals, micro-processes and practices to provide new insights into institutional dynamics and change (Aten, Howard-Grenville & Ventresca 2012; Battilana, Leca & Boxenbaum 2009; Greenwood et al. 2008; Lawrence, Suddaby & Leca 2011; Norus 1997; Powell & Colyvas 2008; Reay, Golden-Biddle & Germann 2006; Zilber 2012). This section of the thesis considers the contribution that a focus on micro-processes as a level of analysis can bring to the institutional entrepreneurship literature and reviews some key empirical studies that have done so. This is relevant to consider because (as was highlighted in the previous chapter) there is a need to examine the decision-making process associated with energy efficiency projects at the micro level; that is, at the level of individual decision-making, as well as to link action on projects with an organisational and organisational field-level context. Also, it is relevant to examine the role that individuals play in raising the focus of energy efficiency in their organisations in order to accelerate energy efficiency improvement.

5.5.1 The rationale for considering the individual in institutional analyses

As discussed previously in this chapter, an important strength of the institutional approach is the concept of the organisational field. Analysis at the field level is that the transfer of ideas, technologies, practices and institutional forms occurs across the boundaries of organisations (Powell & Colyvas 2008). The micro and individual levels of analysis have received much less attention in the institutional theory literature (Battilana, Leca & Boxenbaum 2009; Suddaby 2010a). However, ultimately, institutions are created and enacted by individuals. As Powell and Colyvas (2008, p. 277) describe them, institutions are: “reproduced through the everyday activities of individuals”.

Analysis at the micro level allows for unique perspectives in a number of areas including the:

- ways in which individuals influence the development of institutions and dynamics of institutional change (Lawrence, Suddaby & Leca 2011, Maguire, Hardy & Lawrence 2004, Powell 2008)
- conditions under which individuals might be encouraged to act (Zilber 2012), and the different forms of influence that an individual might use (Battilana, Leca & Boxenbaum 2009).

Powell (2008) argues that attention should not just focus on individuals within powerful positions. This is an important consideration as a focus on obviously powerful individuals within a field may lead to overly heroic representations of their abilities and influence.

To illustrate the value of incorporating the individual and micro level within institutional studies, four empirical studies are considered. These are authored by:

1. Reay, Golden-Biddle and Germann (2006)
2. Barley and Tolbert (1997)
3. Lounsbury and Crumley (2007), and
4. Rothenberg (2007).

Reay, Golden-Biddle and Germann's (2006) study highlighted the ways in which middle managers used their knowledge of the Canadian Health System to progressively implement changes that established 'Nurse Practitioners' as a legitimate role. The authors observed that, by focusing on the actions of individual actors, seemingly isolated examples of new practice evolution eventually led to legitimate new ways of working that became 'taken for granted' across the organisational field. The study presented actors as skilled and experienced. Their experience allowed them to recognise the most appropriate and effective strategies to influence institutional change. This involved using the context that they operated within to achieve their goals. This important finding contrasts with the dominant perspective within institutional studies that embeddedness is primarily a constraint on change. With regard to the origin of change, the authors were unable to identify an external jolt that provided the genesis of the change process.

Reay, Golden-Biddle and Germann (2006) were able to build on Barley and Tolbert's (1997) study containing explanations of micro level change by showing how individual actors create and replicate new scripts that they consider appropriate for their workplace. In particular, Barley and Tolbert's study contrasts with studies that present embeddedness as a constraint by demonstrating the way in which actors used their embeddedness to create change at the micro level that ultimately influenced practices at the macro level. The study also highlighted the role that middle managers can play in initiating change as they worked to influence the actions of both front-line workers and upper-level managers.

Although the term 'performativity' was not used within the Golden-Biddle and Germann (2006)study, the description provided appears to be consistent with Lounsbury and Crumley's (2007) study into the emergence and broad acceptance of new money management practices in the United States mutual fund industry. Individual performances play a key role in both reproducing and altering a given practice: “through variation in its enactment” (Lounsbury & Crumley 2007, p. 996). Lounsbury and Crumley’s study highlighted the skill of the actors involved as they modified and customised practices to meet the needs of specific audiences and to accomplish particular tasks. This ultimately led to the adoption of new money management practices, which subsequently became widely ‘taken for granted’.

Rothenberg (2007) examined the role of environmental managers as institutional entrepreneurs and the influence that different institutional contexts can have on waste management practices within a multinational corporation. The study has drawn attention to the unintended consequences of policy analyses; for example, assumptions that coercive influences may be stronger than normative influences. It has also demonstrated how environmental managers act as ‘boundary spanners’ – providing an important link between the institutional drivers and the micro practices occurring within the firm. The importance of building these links from the individuals to the organisation are discussed in the next section of the chapter.

5.5.2 Implications for the research presented in this thesis

Institutional researchers have called for the incorporation of individual-level analysis within institutional theory. This can provide a number of theoretical insights into institutional dynamics since ultimately, institutions are: “reproduced through the everyday activities of individuals” (Powell & Colyvas 2008, p. 277). An important research consideration is the role that individuals play in institutional change and the conditions under which individuals are enabled to act in relation to changing energy management practices. The literature review on energy efficiency and energy management has highlighted two particular micro level analyses that could provide useful insights into the dynamic process of institutional change:

1. The first area relates to the individuals that are involved in making a decision on whether to support or reject a proposed energy efficiency project. The review in Chapter 3 highlighted that the dominant theoretical perspective applied to understand the energy efficiency gap (i.e. neoclassical economics) assumes that decision-makers aim to make rational decisions in the best interests of their organisations (Biggart & Lutzenhiser 2007). The behavioural perspective loosens this assumption somewhat in acknowledging the ‘bounded’ nature of rationality

and allows for the influence of cognitive limitations, values, motivations and bias in the individual. The review also noted that the wider organisational and interorganisational context could influence such decisions. Thus, the question is raised: How does the organisational and field-level context influence individual decision-making on energy efficiency projects?

2. The second focus area for individual-level analysis is on the energy management practitioner; that is, the person within the organisation who has responsibility for improving the organisation's energy performance. They have a unique role in that they have the responsibility and are expected to influence and work widely across their organisation. The question that arose in the previous chapters is: How do corporate energy practitioners influence institutional change?

A key question is whether and how they act as institutional entrepreneurs. The criteria proposed by (Battilana, Leca & Boxenbaum 2009) that institutional entrepreneurs are actively involved in change and institute divergent changes is adopted in this thesis. The authors define divergent changes as those that: "break with the institutionalized template for organizing within a given institutional context" (Battilana, Leca & Boxenbaum 2009, p. 68).

In keeping with the earlier discussion of distributed agency, care should be taken not to isolate individual-level analysis from the wider institutional context and attention should be paid to obviously powerful actors as well as those who are less visible, hence avoiding he depiction of actors being overly powerful. The next section of this chapter considers how individual-level analysis might be linked to organisational and field-level analyses to provide important insights into institutional development.

5.6 Examining multiple levels of analysis

The call from researchers to develop more comprehensive accounts of human agency was considered earlier in this chapter. Adopting a distributed view of agency was identified as one important way of addressing this challenge and, in turn, developing a more informed and integrated view of institutional entrepreneurship and change. The gap in research that considers the role of individual actors was then discussed with reference to the theoretical insights gained from recent studies.

This section of the chapter considers the value in undertaking multi-level studies. In particular, it highlights the benefits of research that examines the linkages between the micro and individual level of analysis together with organisational and field-level activity. The section concludes with a summary of the key considerations for developing a multi-level model in this research.

5.6.1 The benefits of adopting a multi-level approach to institutional analysis

As discussed previously in this thesis, localised organisational fields have been the most common level of analysis within institutional theory. Field-level analysis helps to explain how local social orders are created, maintained and transformed across populations of organisations (Fligstein 2001; Scott 2001). However, researchers also acknowledge that fields are ‘nested’ and may be examined at a number of different levels, such as the world system, society, organisational field, organisational population, organisation, and organisational subsystem levels (Scott 2001).

As Holm (1995) describes it, first-order systems may be defined by second-order institutional systems (and so on). Change that occurs at one level may then lead to change at other levels. Considering fields as nested systems highlights the potential that an event at one level may influence reactions and cumulative changes at other levels; for example, changes at the first-order level may provide a foundation for further change at a higher level. Holm (1995) also suggests that the nested systems perspective means that a triggering of change by external events may lead to unexpected impacts as the interpretation and response to such changes at lower levels are redirected. The value of the nested systems perspective is that it helps to distinguish between practical action, which is guided by institutions, and political action, which aims to change institutions.

By linking micro processes with macro processes, multi-level institutional studies can provide a more developed account of institutional dynamics (Barley & Tolbert 1997; Powell & Colyvas 2008; Schneiberg & Clemens 2006). Such studies can also provide specific insights into the work of institutional entrepreneurs (Battilana, Leca & Boxenbaum 2009; Reay, Golden-Biddle & Germann 2006) and provide more comprehensive depictions of organisations by demonstrating that their responses are not strictly determined by the influence of institutions (Hoffman 2001).

The work of Schneiberg and Clemens (2006), Hoffmann (2001) and Shultz (Schultz 2012; Schultz & Hinings 2012) outline important considerations for the development of multi-level analytical models. Schneiberg and Clemens (2006) challenge the focus on homogeneity in the organisational response across fields and encourage researchers to emphasise the segmented and multi-level character of fields to explain diffusion that occurs: "in an uneven, lumpy fashion" (Schneiberg and Clemens 2006, p. 205).

A multi-level model developed by Hoffmann (2001) provides useful insights into the development of the theoretical framework for this thesis. Hoffman proposed a multi-level model that links organisation and field-level analysis. The model aims to pay balanced attention to the influence of the organisational field and the role of organisational-level actors as they interpret and respond to institutional pressures. Two categories of analysis included in the multi-level model are:

1. Field-level communities of corporate environmental practice. As discussed previously, there has been a tendency to focus on powerful individual organisations (e.g. the state) and to consider the impact that it has on organisations. Organisations are typically treated as homogenous entities. Hoffman suggests that there has been limited attention paid to the collective influence of the many different constituents in the field and the differential influence they have on actors within organisations themselves. In applying the multi-level model to the case of corporate environmental behaviour (the second category), Hoffman identifies key field constituents as social activists, shareholders, regulatory agencies and suppliers.

2. Occupational communities within organisations that could be expected to respond in different ways to the pressure exerted by external actors. This is a notion that requires further research. Hoffman suggests that the composite effect of the pressure from diversity amongst the field constituents may be quite different to the effects observed when each of these actors is considered in isolation.

With regard to the energy efficiency gap and the development of energy management practices, the multi-level model developed by Hoffman raises an important question about the mechanisms by which organisations interpret and then respond to the changing constituency of the field associated with energy management practices. One limitation of Hoffman's model is that its intention is to examine the influence of institutions on organisational actors, but there is limited consideration of the influence that organisational actors have on institutions. This is a research gap that will be examined in the empirical research conducted in this thesis.

5.6.2 Implications for the research presented in this thesis

This section has explored the value of and key considerations for developing a multi-level model of institutional analysis that links individual, organisational and field-level analysis. As well as providing important insights into institutional entrepreneurship and the influence of distributed agents in effecting institutional change, such an approach can also provide more sophisticated explanations for non-isomorphic (i.e. diverse) organisational responses, the complex nature of organisational fields and the process of change within these fields.

A number of important perspectives have been gained that may be considered in developing a multi-level model of analysis. Schneiberg and Clemens (2006) described four linkages between institutional fields and organisations that can be considered. These are:

1. direct ties to field-level bodies
2. certification, accreditation or legitimation by an institutional authority
3. connections to or conduits for, institutional models, and

4. proximity, visibility or vulnerability to institutional pressure.

Hoffman (2001) highlighted the relevance of examining ‘occupational communities’, both within organisations and within organisational fields. These communities may be examined to identify how issues are framed in order to be relevant for other communities. This examination can help to explain the differential effects of institutions as they impact on organisational responses.

5.7 Gaps in the institutional entrepreneurship literature

This chapter has introduced the key features of institutional theory and examined a number of research gaps associated with explanations of institutional entrepreneurship and change. It has highlighted that, since the notion of institutional entrepreneurship was first introduced by DiMaggio in 1988, institutional researchers have been challenged to explain the way in which actors change institutions when actors are themselves subject to institutional pressures. This is the so-called ‘paradox of embedded agency’. Five explanations for institutional change have been presented, including:

1. exogenous jolts
2. dialectical perspectives
3. performativity as an outcome of practice variation
4. the level of embeddedness and social position of actors, and
5. the social skills of actors.

Hargrave and Van de Ven’s (2006) typology of institutional change models has also been introduced. Their work, and that of other institutional scholars, suggests that collective action models: “examine the construction of new institutions through the political behaviors of many actors who play diverse and partisan roles in the organizational field or network that emerges around a social movement or technical innovation.” (Hargrave & Van de Ven 2006, p. 868). This area has been under theorised and provides an important area for future research.

Some institutional theorists have been critical of the way in which human agency has been depicted as either over socialised or powerless . This has led to calls for institutional researchers to develop more informed and integrated models to examine institutional entrepreneurship; for example by examining human agency as a distributed and collective phenomenon (Fligstein 2001; Powell & Colyvas 2008; Suddaby 2010b).

The notion of distributed agency has been introduced as an important way of supporting research into collective action models and addressing the critique of institutional scholars that actors have typically been presented as socially determined 'cultural dopes' (at one extreme) or as heroic actors able to overcome institutional pressure with relative ease (at the other extreme). A distributed view of agency has the potential to address these shortcomings by focusing on the interactions between different actors that are distributed across "multiple dimensions including space, status and time" (Lounsbury 2007, p. 1007).

Two related research issues were examined to consider their relevance for the design of research that adopts a distributed view of agency (i.e. a perspective that examines the interactions between multiple actors rather than focusing on single actors in isolation):

1. The research discussed a call from institutional researchers for studies to provide more focused attention on individual actors. Since individuals influence the development of institutions and dynamics of institutional change (Lawrence, Suddaby & Leca 2011; Maguire, Hardy & Lawrence 2004; Powell 2008), important insights into the conditions under which individuals might be encouraged to act (Zilber 2012), and the ways in which individuals influence institutional change (Battilana, Leca & Boxenbaum 2009(Fligstein & McAdam 2011; Lawrence, Suddaby & Leca 2011), may be forthcoming.

2. The relevance of multi-level studies linking individual, organisational and field-level change was also examined. Researchers have suggested that in linking micro processes with macro processes, multi-level institutional studies can:

    - provide a more realistic account of institutional dynamics (Hoffman 2001; Barley & Tolbert 1997; Lawrence & Suddaby 2006; Powell and Colyvas 2008; Schneiberg et al. 2006; Suddaby 2010)
    - provide specific insights into the work of institutional entrepreneurs

(Battilana, Leca & Boxenbaum 2009; Reay et al. 2006), and

- demonstrate that their responses are not strictly determined by the influence of institutions (Hoffman 2001).

5.8 The three-level change model

Characteristics of the model

The review of the energy efficiency, institutional entrepreneurship and institutional theory literatures in this and previous chapters has informed the development of the model presented in Figure 5.3. Figure 5.4 incorporates the research questions into the model. The model has four key characteristics. The following paragraphs describe these characteristics and reference the relevant sections of the literature review in this and preceding chapters that inform model development.

Characteristic 1: The model supports multi-level analysis

Chapter 4 identified the various theoretical perspectives and levels of analysis that researchers have applied to examine the barriers to energy efficiency improvement in organisations. The review concluded that analysis across multiple levels of analysis could provide new perspectives on the causes of the energy efficiency gap in organisations and how they can be resolved (see Chapter 4, Section 4.7). The review of the institutional literature in Chapter 5 has supported this approach. For example, Section 5.6 explained that institutional theorists support multi-level analyses as it can provide more comprehensive accounts of institutional dynamics than are typically achieved through single levels of analysis (Barley & Tolbert 1997; Powell & Colyvas 2008; Schneiberg & Clemens 2006).

The three levels of analysis selected for this study are the:

1. organisational field level
2. organisational level, and
3. project level.

The rationale for selecting these levels of analysis is presented in the summary below.

Figure 5.3: Three-level model to examine institutional change

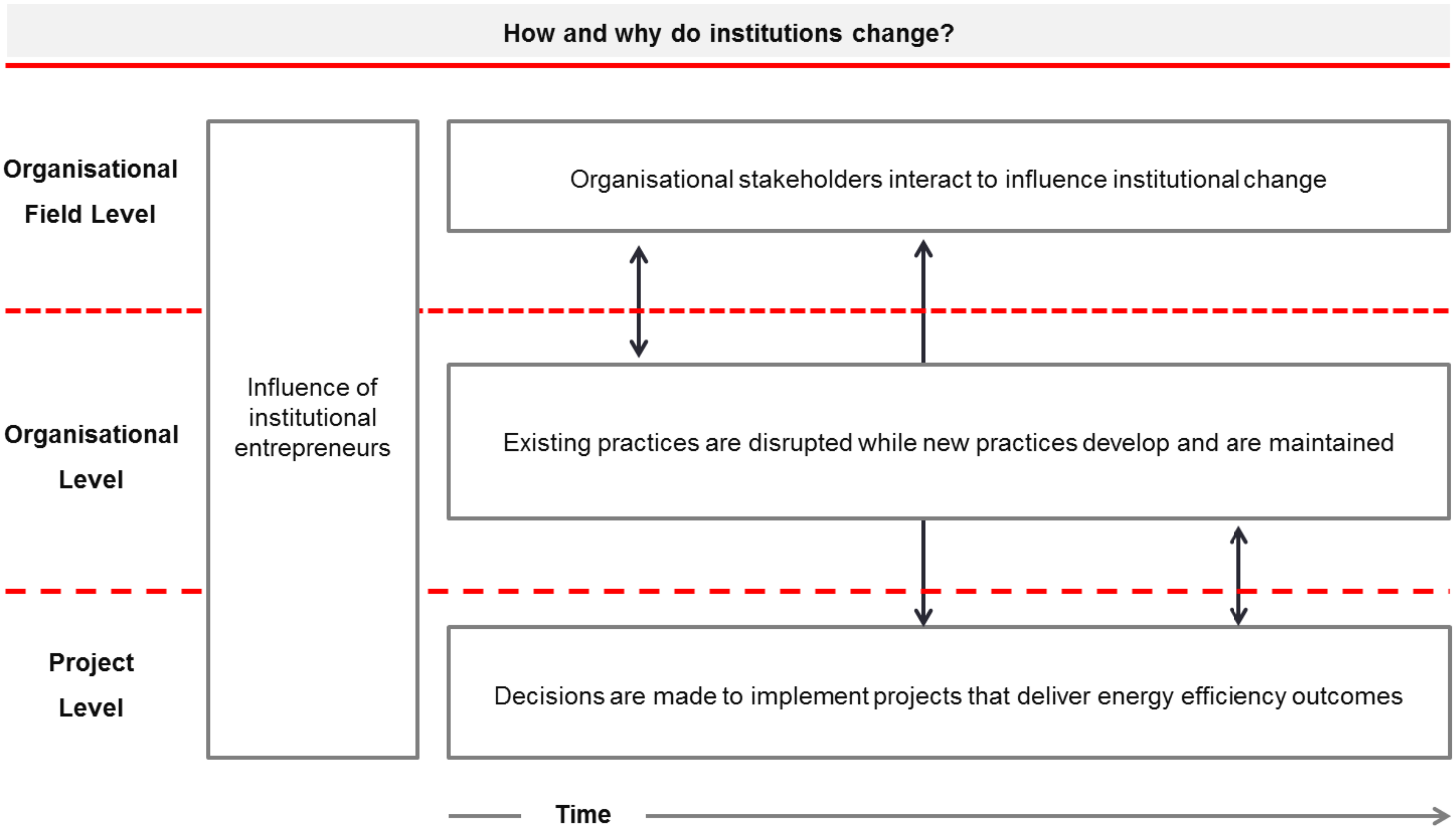
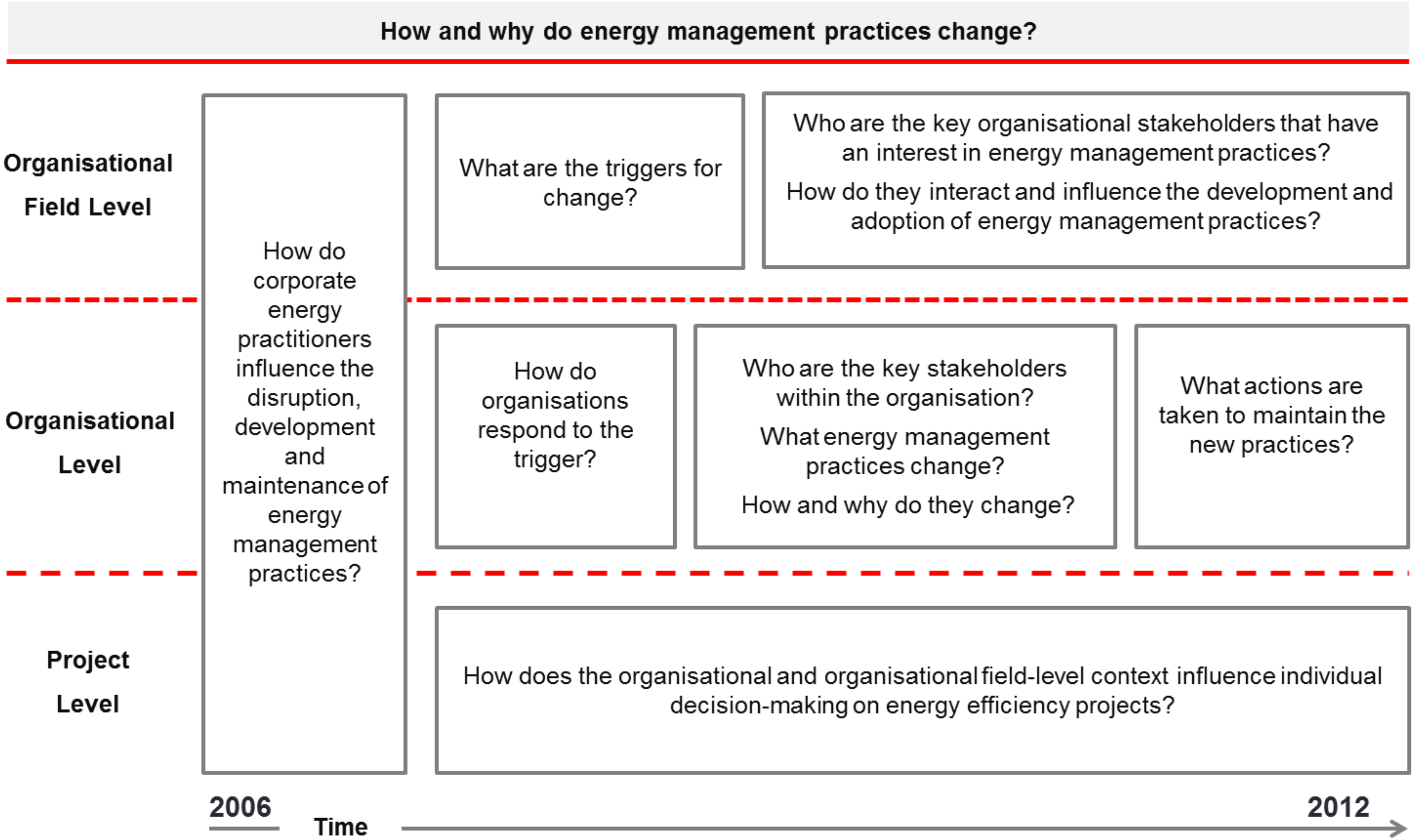


Figure 5.4: Three-level model applied to the case of changing energy management practices in Australia



Organisational field-level analysis

A strength of organisational field-level analysis is that it can highlight the interactions between multiple organisations with common interests (Powell 2007). Analysis at the organisational field level can build on and extend recent studies in the energy efficiency literature that examine interorganisational influences on an organisation's energy efficiency performance (see Chapter 4, Section 4.6; examples include (Biggart & Lutzenhiser 2007; Palm & Thollander 2010; Warren-Myers 2012)). Further, analysis at the organisational field level can highlight the combined effects of multiple government policies that aim to influence the adoption of energy management practices – an important issue that was highlighted in Section 3.4.

Organisational-level analysis

Organisational-level analysis is appropriate since it is at this level that organisations primarily apply energy management practices (see Chapter 3, Section 3.3). Further, there remain unresolved issues in the existing energy efficiency literature with respect to the dynamics by which external stakeholders motivate the development and adoption of energy management practices at the organisational level (see Chapter 4, Section 4.5).

Project-level analysis

The analysis of individual decision-making at the project level has received significant attention from researchers adopting neoclassical economic and behavioural perspectives (see Chapter 4, Section 4.3, and Section 4.4). It is at the project level that the benefits of energy management practices are realised as projects are implemented to deliver tangible outcomes. However, it is unclear how stakeholder dynamics at the organisational level and organisational field level influence individual decisions to implement energy efficiency projects (see Chapter 4, Section 4.4.1) and the influence that individuals with responsibility for energy efficiency improvement within organisations have on changing energy management practices.

The model will also examine interactions between each of these levels. For this reason the arrows shown in the model illustrate bidirectional influence (see Figure 5.3)

Characteristic 2: The model aims to expose the skills and strategies of individual institutional entrepreneurs

The review of energy management practices has highlighted the important influence that individuals with responsibility for progressing energy efficiency improvements in their organisations can have on the adoption of effective energy management practices (see Chapter 3, Section 3.3, and Section 3.4). However, energy efficiency policies that encourage the establishment of an individual with responsibility for energy efficiency improvement may contribute to unintended consequences. For example, organisations may allocate the role to a person with insufficient skills (Ates & Durakbasa 2012) and/or organisations may approach energy efficiency as a compliance activity, rather than as an opportunity to improve their business performance. This can make it difficult for an 'energy manager' to implement energy management practices (Shen, Price & Lu 2012).

The model aims to provide insights into the strategies and skills that successful institutional entrepreneurs apply to facilitate institutional change. In Chapter 5, Section 5.2, institutional entrepreneurs were introduced as "change agents who actively participate in the implementation of changes that diverge from existing institutions" (Battilana, Leca & Boxenbaum 2009, p. 70). Specifically, this thesis will examine how corporate energy practitioners may act as institutional entrepreneurs by disrupting, developing and maintaining new energy management practices. This thesis defines a 'corporate energy practitioner' as an individual who:

- has a corporate role in a large energy consuming organisation
- is responsible for improving the overall energy efficiency performance of their organisation and ensuring that legislative requirements are met, and
- has visibility and influence across multiple operating sites within their organisation. This might include factories, buildings and a mobile fleet (e.g. trucks and/or cars).

Practitioners exhibiting these characteristics may also be responsible for other issues; for example, corporate sustainability, operational management or environmental management.

Characteristic 3: The model accounts for the interactions between multiple stakeholders as they influence institutional change

The energy efficiency literature review has highlighted how influences on energy management practices in organisations are complex in that they involve multiple internal and external stakeholders (see Chapter 3, Section 3.4). The review of the institutional theory literature has highlighted how examining the interactions between multiple stakeholders can provide new perspectives on the way stakeholders interact to create institutional change (see Chapter 5, Section 5.4). The model will provide a mechanism to analyse *who* the stakeholders are at each level of analysis and *how* they interact. It will also reveal the way in which the stakeholders directly and indirectly influence change in energy management practices.

Characteristic 4: The model examines the dynamic process of change over time

The energy management literature has highlighted that researchers have examined energy management practices as a static phenomenon (see Chapter 3, Section 3.3). By examining the process of change over time, the model aims to identify the dynamic changes and interactions between stakeholders as they occur across the institutional lifecycle; that is, from the disruption through development and maintenance of energy management practices.

Incorporating the research questions into the model

Figure 5.4 illustrates how the research questions are incorporated into the model. For clarity, the origin of each of the research questions is summarised here.

The primary question is: *How* and *why* do energy management practices change? This question emerged from the review of existing energy management practices which highlighted the fact that limited research has been carried out that examines the development and adoption of energy management practices in organisations as a dynamic phenomenon (see Chapter 3, Section 3.3). By examining how and why existing practices are disrupted and new practices develop and are maintained over time, this research will contribute new perspectives on the dynamic process of institutional change and will provide practical insights into how government policymakers can support the adoption of effective energy management practices in organisations .

The secondary questions that emerged from the literature review support examination of the dynamics of institutional change. These are set out and discussed in the following paragraphs.

How do corporate energy practitioners influence the disruption, development and maintenance of energy management practices?

As discussed previously, corporate energy practitioners are in a unique position to influence change across each of the three levels (i.e. the project, organisational and organisational field levels) identified for this analysis. Analysis of the way in which these levels influence change will form an important part of the study.

Who are the stakeholders that influence energy management practices and how do they affect change?

This question responds to calls from institutional researchers to provide more comprehensive accounts of institutional change by examining the individual and collective influence of multiple stakeholders involved in disrupting existing institutions and shaping emerging institutions (see Chapter 5, Section 5.4). This question will be applied at both the organisational and organisational field level in the model. Then, at the project level, the influence of these stakeholders on individual decision-making will be examined.

What are the triggers that precipitate changes in energy management practices?

This question considers how institutional change begins and/or is accelerated (see Chapter 5, Section 5.3). At the interorganisational level, this involves consideration of whether the EEO legislation played a substantial role as a trigger and what the additional influences were that occurred over the study period. At the organisational level, the response by large energy consuming organisations to these triggers will be investigated.

5.9 Summary and conclusions

This chapter has developed the theoretical framework and a model to address the research question: *How* and *why* do energy management practices change? The key characteristics of the model are that it:

- supports analysis within and across the organisational field level, organisational level and project level
- exposes the skills and strategies of individuals as institutional entrepreneurs
- accounts for the interaction between multiple stakeholders as they influence institutional change, and
- examines the dynamic process of change over time.

Chapter 6 outlines how this thesis applies the model to examining the case of changing energy management practices in Australia between the years 2006–2012.

6. Methodology

6.1 Introduction

This study emerged from the author's observation that potentially significant changes in energy management practices were occurring within large energy consuming organisations in Australia that had obligations under the Energy Efficiency Opportunities (EEO) legislation. The EEO legislation commenced in July 2006 and requires organisations using more than 0.5PJ to conduct energy efficiency assessments and report publicly on the outcomes of these assessments annually. Consolidated analysis of the public reports from organisations with obligations under the EEO legislation found that significant energy efficiency outcomes and a range of additional business benefits were being reported (RET 2012b).

However, the legislation was not the only business driver for organisations to reconsider their approach to energy management. Following the commencement of the EEO legislation, many of the same organisations were required to report to the government under the *National Greenhouse and Energy Reporting Act 2007* (Cth) (NGER Act). There had also been substantial attention paid in the national discourse to the introduction of a carbon pricing mechanism which was, ultimately, introduced in July 2012. Additionally, electricity and gas prices had begun to rise from 2007 after a long period of relative stability. There were also indications that a range of organisational stakeholders,[8] including customers, the community and investors, were taking a greater interest in the way in which companies were managing their energy use and taking action to minimise the greenhouse gas emissions associated with their operations.

Whilst it was evident that this complex social setting had led to the emergence of new energy management practices, the causal dynamics were not immediately apparent and the motivation of multiple stakeholders was obscure. For these reasons a focus on Australian organisations with liabilities under the EEO legislation over the period 2006–2012 was considered to provide a valuable setting in which to examine the primary

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[8] As mentioned earlier in the thesis, the term 'stakeholder' (as it is used in this research) refers to an individual or organisation with an interest in the energy efficiency performance of one or more large energy consuming organisations in Australia.

research question presented in this thesis: *How* and *why* do energy management practices change? In so doing, this would also provide new perspectives on the dynamic process of institutional change. The aim of this chapter is to describe the key features of the research design, which are listed in Table 6.1.

Table 6.1: Key features of the research design

Feature	**Description**
Research question	*How* and *why* do energy management practices change?
Methodological assumptions	Social constructionism: • Knowledge is constructed through the shared meanings interpreted by social groups.
	Process perspective: • The research is concerned with the way in which change unfolds over time and the factors that influence change.
	Use of qualitative data: • Qualitative data supports the examination of complex social processes.
Approach and analysis	Embedded, single case study design incorporating content analysis, temporal bracketing, visual mapping and narrative development. The data was triangulated across three distinct sources of data. The case is characterised as critical and revelatory.
Level of analysis and research setting	The organisational field associated with energy management practices in large energy consuming organisations in Australia over the period 2006–2012. Organisational and project levels provide embedded units of analysis within the case study.
Perspective	The research draws on the perspective of managers who have had responsibility for progressing energy management improvement within large energy consuming organisations in Australia over the study period. The aim is to advance theory from their viewpoint.
Sampling	Theoretically driven, within-case sampling.
Data sources	• 62 presentations delivered by corporate energy practitioners representing 46 large energy consuming organisations and five consulting firms at public conferences held in 2011 and 2012

Feature	Description
	• nine semi-structured interviews with corporate energy practitioners who had played a key role in introducing and maintaining new energy management practices in their organisations • archival documents consisting of 27 publicly-available case studies that had been developed by the Australian Government in collaboration with organisations throughout the study period.

6.2 Methodological assumptions

The social world can be examined and understood by researchers in many different ways. An important component of any research design is to communicate the underlying assumptions that are held by the researcher about the nature of reality and how things can come to be known (Huberman & Miles 2002; Miles & Huberman 1994). This research is underpinned by the key methodological assumptions of social constructivism and interpretivism. It takes a processual approach to change and utilises qualitative data and analytical techniques which are in accordance with the methodological paradigms.

6.2.1 Social constructivism

The social constructivist ontology maintains that knowledge is constructed through people's interpretations of reality. To illustrate, Berger and Luckmann (1966) propose that what is 'real' to a Tibetan monk is likely to be different to what is considered 'real' to an American businessman. This is because their perspectives, reality and knowledge relate to the particular social contexts that they exist within. According to the social constructivist ontology, knowledge is dependent on the interpretation of people through their interactions in social groups. A social constructivist perspective contrasts with a 'positivist' perspective which assumes that truth and facts exist in their own right – independent of individual and social interpretation.

As Kuhn (1970, p. 210) describes it: “knowledge is intrinsically the common property of a group or else nothing at all”. A social constructivist ontology emphasises the importance of acknowledging the social context that influences the generation of knowledge that may be different within unique social settings (Berger & Luckmann 1966). The social constructivist perspective is compatible with the tradition of institutional theory, since institutions and organisations are considered to be created through: “common understandings and shared interpretations of acceptable norms of collective activity” (Suddaby et al. 2010, p. 1235).

Social constructivist assumptions influence this research in a number of important ways. For example, these assumptions:

- direct attention to the common understanding and shared interpretations informing the way in which energy management practices are undertaken by large energy consuming organisations in Australia. It is not assumed that there is a single ‘right way’ of doing things that can be ‘discovered’. Rather, the aim is to highlight the influence of the wider social context that individuals and organisations find themselves in.
- examine the way in which this context influences decisions and actions that individuals and organisations take, and the meaning that underpins such action.

This study does not intend to suggest that the findings are an absolute objective reality. Rather, the findings are an outcome of a research process in which the interpretations of corporate energy practitioners are analysed for patterns of stability and change in relation to the way in which energy management practices are conducted. Since the research is conducted at the level of social groups, these patterns are not intended to be absolute. Instead, they reflect the interpretation of the corporate energy practitioner’s experience. They also reflect the values and constructs of the researcher – both in the theory used and the subjective influences involved in interpretation.

The idea that research can be conducted in an impartial or detached way has been strongly challenged (Popper 1972). Van de Ven (2007) suggests that for this reason it is important to be clear about the perspective and viewpoints of the researcher as well as those of the research participants.

The research participants in this thesis are all managers or consultants with responsibility for progressing energy performance improvement within large energy consuming organisations in Australia. Each is expected to have a unique perspective on the challenges and opportunities associated with changing energy management practices. It is not suggested that their accounts cover all of the perspectives of change within an organisation.

Data gathered through confidential interviews with the research participants may be expected to reflect the individual views of the participants more than the data gathered from public presentations or case study material available for public consumption. That is because public presentations are likely to reflect the individual's view *as well as* the collective view that managers within a particular corporation would like to have reflected in public. These presentations are likely to have been through a series of review processes within an organisations prior to their presentation in public. That is not to say that such data is not valid – rather it is to acknowledge that the different forms of data may be skewed due to the varied degree of individual and organisational input. To an even greater degree, the third source of data, publicly written case study may represent an even more refined view influenced by the organisation since such documents typically go through multiple iterations and are more easily accessible to the general public due to the more enduring nature of written material.

Drawing on the perspective of these individuals has a number of advantages. Since energy performance improvement has been a primary focus for them over the study period, it is expected that these individuals will have:

- direct experience
- received feedback from managers as well as objective measures on what practices have and have not worked in their organisations
- information on the way in which change has progressed over time, and
- information on other challenges that have been faced along the way.

It is acknowledged that such a perspective will be highly subjective to their experience. However, since there are a large number of subjects involved in the research, this should allow for general patterns of change to be drawn from their accounts.

The researcher on this thesis also has direct experience working with organisations on energy management issues over a period of more than 15 years. Although the research process has been approached in a systematic way to allow for comparison across the board, it is accepted that the researcher's direct experience may influence the selection of some events and issues as being more critical than others (Babb 2006). To address these challenges the researcher obtained review from supervisors acting as 'critical friends' throughout the research process. Following Alveeson and Sköldberg (2009) the researcher has also established a structured process of reflection on his own thinking and assumptions throughout the research process.

Although this presents the potential for bias, it can also be considered a strength. In particular, the challenge of working through a significant amount of qualitative data to highlight issues of relevance to both practitioners and research more generally may be considered to be enhanced by this direct experience and to support deeper insights than may have been obtained without this experience. It may also contribute towards deeper questioning.

The researcher is also known to the presenters and was involved in the conferences as a facilitator. The researcher also co-authored a number of the publicly available case studies used in this research as indicated below. It is expected that this has been a positive aspect in that it has facilitated access to the participants, allowed for deeper questioning during the interview process and has, ultimately, helped the researcher to "understand the dynamics confronting managers who are directing the change effort, and therefore generate new knowledge that advances the theory and practice of managing change" (Van de Ven 2007, p. 206).

The research conducted for this thesis has ethics approval from the University of Technology, Sydney Human Research Ethics Committee. The approval number is 520111396.

6.2.2 A process perspective

A process perspective aims to explain phenomena by describing: "patterns in events, activities and choices over time" (Langley 2009, p. 411). Process research emphasises the importance of identifying links between the substance, context and politics of change as it occurs (Dawson 1997). Rather than attempting to provide explanations between independent and dependent variables, the focus of process research is on the way in which events lead to an outcome. This is typically achieved by tracking change over time, examining behaviour rather than conditions and examining 'what happens in response to what'(Sminia 2009, p. 100). By describing a sequence of events over time in a narrative, research conducted from a process perspective may also be more accessible to practitioners (Rynes 2007). Another advantage of a process perspective is that examining how changes in practices occur over time and the ways in which individuals and organisations interact within a wider interorganisational context can provide a more dynamic understanding of the ways in which change can be more effectively implemented in terms of the goals of a change program (Langley 2009).

Process research contrasts with and addresses limitations associated with variance research (Meyer, Gaba & Colwell 2005). Variance methods help to explain why one organisation performs better than another, but typically do not provide insights into the way in which an organisation or phenomenon changes from one level of performance or outcome to another. Variance research may highlight that firms with a particular characteristic are likely to perform better than firms with another characteristic, but such research does not provide insights into *how* firms might *develop* the desired characteristic (Langley 2009).

A process perspective is particularly suited to the aims of this research, which are to understand how and why change occurs over time, rather than to compare the static performance of one organisation with another. The change that the research aims to explore is at the level of the organisational field; that is, it examines how multiple actors with an interest and influence on energy management practices affect change – not just at a single point in time, but over a period of six years. A process perspective is appropriate in answering questions of 'whom', 'why' and 'how', rather than 'whether' and 'when' (Suddaby & Greenwood 2009).

This study is built on an ontological perspective that considers change to be a complex and dynamic process that evolves over time. Rather than approaching change as a substance or a property of individuals and organisations (Langley & Tsoukas 2010), it is considered an ongoing process in which the beliefs of actors and their habits of action are modified through new experiences that occur through their interactions with other actors (Tsoukas & Chia 2002). This perspective is compatible with an interpretivist approach in which the research aims to uncover how people involved in change understand their experience in the process.

6.2.3 Qualitative data

Both qualitative and quantitative data can be used in process research. Multivariate, quantitative methods have provided the dominant empirical approach within institutional theory that aims to explain stability. However, qualitative methods have been more prevalent in considering institutional entrepreneurship and change. Multivariate approaches: "give attention to discrete and observable elements of organizations that change in response to change in institutional pressures" (Suddaby & Greenwood 2009, p. 178). As discussed in Chapter 5, such methods have been predominantly applied to research questions associated with institutional adaptation and diffusion (Hargrave & Van De Ven 2006). A central objective in this type of variance research has been to examine the conditions under which particular outcomes will be achieved (Van de Ven & Poole 2005).

Entrepreneurial action that aims to change prevailing social norms can be more difficult to observe than the homogeneity of structures in an organisational field (David & Bitektine 2009). To understand the reasons why institutional entrepreneurs might challenge prevailing social norms, research on institutional entrepreneurship has typically used an interpretivist approach, gathering qualitative data that provides insights into the subjective perceptions of actors and the processes by which change occurs (Leca, Battilana & Boxenbaum 2006; Suddaby & Greenwood 2009). Institutions are considered to be formed as meanings become shared and, ultimately, taken for granted. Individual interpretations of meaning play an important role and the development of social meaning involves negotiation amongst various parties in order to create a shared meaning (Hardy & Maguire 2008; Zilber 2006).

Eisenhart and Graebner (2007) refer to the outcomes achieved from the research of Greenwood and Suddaby (2006) in suggesting that qualitative data offers insight into complex social processes that would not be easily revealed if quantitative data was used in the research. David and Bitektine (2009) suggest that studies by Greenwood, Suddaby and Hinings (2002) and Maguire, Hardy and Lawrence (2004) would not have been accepted as providing the same rich insights, were it not for the rising acceptance of qualitative research as a valid method. Suddaby and Greenwood (2009) encourage the use of qualitative methods to build understanding of the way in which institutional processes occur.

Researchers have called for more comprehensive depictions of institutional entrepreneurship by examining human agency as a distributed phenomenon (Battilana, Leca & Boxenbaum 2009; Dorado 2005; Garud & Karnøe 2003; Hargrave & Van De Ven 2006; Lawrence, Suddaby & Leca 2011). In seeking to examine the interaction between actors, qualitative research can offer: "comprehensive descriptions that provide a deeper understanding of the actors' actions, their reasons to act and their subjective perceptions, as well as to gain a detailed knowledge of the process" (Leca, Battilana & Boxenbaum 2006, p. 21). Further, such approaches can provide researchers with an opportunity to examine the efforts of individual actors in creating institutional change, the way in which individual contributions combine, the response that actors have to each other and how the overall contribution of these leads to institutional change and stability (Garud & Karnøe 2003; Lawrence, Suddaby & Leca 2011).

An important issue related to qualitative case study research is the extent to which the findings can be generalised across other settings. It is important to clarify that the aim in this thesis is not to identify a sample and generalise the findings towards a population. Rather, the aim of this research is to generalise the theoretical propositions as a means of expanding and generalising theory (Athens 2010; Eisenhardt & Graebner 2007; Greenwood & Suddaby 2006) .

6.3 Case study method and design

It has been argued earlier in this thesis that existing approaches to researching the energy efficiency gap have been constrained by the focus on individual actors and the market as primary units of analysis. Recent work has begun to examine the organisational and industry-level contextual factors that influence the uptake of energy efficiency in organisations. The literature review has indicated the need to conduct research that views changes in energy management practices as a dynamic process, influenced through the interaction of multiple individual and organisational actors. Such research has the potential to challenge existing assumptions about the reasons for the energy efficiency gap and the actions that might be taken to address it.

Moving towards a more comprehensive understanding of the energy efficiency gap does, however, present distinct challenges. A single case study design has been selected for this study as it is the best way of addressing these challenges. The scope, rationale and details of the case study design are presented in the following paragraphs.

6.3.1 Scope of the case study

According to Yin (2009, p. 18), a case study is: “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context”. One particular advantage of the case study method is that it provides a systematic way of describing and documenting complex events to observe patterns that would otherwise remain hidden (Hancock & Algozzine 2006). Case study method is particularly appropriate when the boundaries between a particular phenomenon and the context are not clear (Yin 2009) and when research aims to capture contemporary phenomena and provide new insights into complex and interrelated issues (Eisenhardt 1989). For these reasons case study method is considered appropriate for the research presented in this thesis.

Miles, Huberman and Saldaña (2013, p. 28) define a case in abstract terms as: “a phenomenon of some sort occurring in a bounded context.” A critical aspect of case study design is to define the phenomenon that is the focus of the case study as well as the boundaries. An essential question to clarify is: “What is the ‘case’ in the case study?” (Platt 2007). Table 6.2 sets out the case study boundaries and descriptors. These are then discussed in more detail.

Table 6.2: Case study boundaries and descriptors

Boundary	**Descriptors**
Phenomena being investigated	Corporate energy management practices and the institutions that form around and influence those practices
Level of analysis	The organisational field and the institutions that form around energy management practices in Australia
Embedded units	• Large energy consuming organisations in Australia: defined as organisations using more than 0.5PJ of energy annually and fulfilling other criteria requiring participation under the EEO legislation • Projects that are developed within these organisations that aim to improve energy performance • Stakeholders that form the organisational field associated with energy management practices
Geographic location	Australia
Timeframe	2006–2012
Characteristics of the case	Critical and revelatory
Sampling approach	Theoretical sampling; that is, organisations that were able to clearly demonstrate that they had changed their corporate energy management practices were selected with the aim of providing theoretical insights rather than generalising the findings to a wider population.

Corporate energy management practices and the institutions that form around them are the core phenomena examined in this case study. By way of explanation, institutions have traditionally been viewed as forming around industry groupings, markets and technologies. However, more recent studies have examined the formation of institutions around new management practices (Lounsbury & Crumley 2007; Perkmann & Spicer 2008; Reay, Golden-Biddle & Germann 2006). Consistent with these developments, the focus of this case study is on the institutions that form around and influence energy management practices.

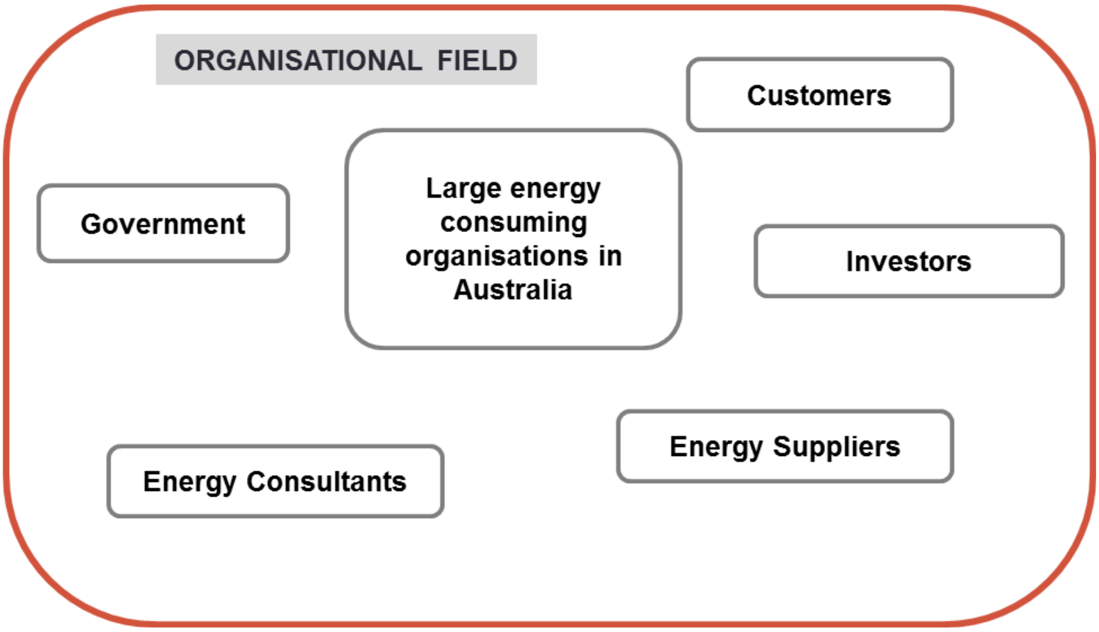
As defined in Chapter 3 (Section 3.2), energy management practices are understood to be “activities recognised by a community as the legitimate means of coordinating around energy use in accordance with the goals of an organisation.” Large energy consuming organisations are defined as those using more than 0.5PJ of energy in a 12 month period within Australia. This definition is consistent with the legislative threshold for organisations with obligations under the EEO legislation. As of 1 May 2012 there were 319 organisations with obligations under the EEO legislation operating in Australia (RET 2012b).

An important component of case study design is to clarify the scope, levels of analysis being undertaken and the boundaries of the case study. In this research, the primary level of analysis is the organisational field associated with energy management practices in large energy consuming organisations in Australia. DiMaggio and Powell (1983, p. 148) describe an organisational field as encompassing: “… those organizations that, in the aggregate, constitute a recognised area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products”. Although large energy consuming organisations are well defined from the outset of this study, other constituents in the organisational field are not. Stakeholders that make up the organisational field associated with energy management practices may include government, investors, customers and energy suppliers (see Figure 6.1). Important research questions associated with the organisational field include:

- Who are the key stakeholders involved in change?
- How do these stakeholders influence the process of change directly and through their interactions with other stakeholders? (see Chapter 5, Section 5.8 for an explanation of the origin of these questions).

The stakeholders within the organisational field are expected to be revealed inductively through analysis of the data, which is expected to reveal key stakeholders, the energy management practices that are developed and the dynamics through which these practices evolve over time.

Figure 6.1: Potential stakeholders in the organisational field associated with energy management practices



Although the primary level of analysis is the organisational field associated with energy management practices, this research aims to examine change in those practices as they occur at multiple levels. For this reason, the case may be characterised as an embedded single-case design (Yin 2009). The 'embedded' sub-units of analysis are large energy consuming organisations in Australia, and the projects that are developed by these organisations with the aim of improving energy efficiency performance and delivering other business benefits.

In developing the research design, the levels of analysis and whether the case study should be developed as a multiple-case or single-case design with embedded units, were considerations. The design could have been examined as a multiple-case study – with each organisation making up a single case with comparison being made across the cases. However, the situation was resolved by considering the primary unit of analysis which, in this case, was the organisational field associated with energy management practices. This field is made up of multiple organisations, including the large energy consuming organisations within which energy management practices are applied. Of particular interest in the case were the interactions between multiple actors and the way in which their actions influenced energy management practices; not just in one organisation, but across a large number of organisations. Therefore, the study is considered to be a single case with the unit of analysis being the organisational field associated with energy management practices in Australia. This approach is further reinforced by the nature of energy management practices as being in a state of flux. Based on their experience in researching nonlinear change in organisational fields, Meyer et al. (2005) have highlighted the importance of raising the level of analysis in these cases to observe the larger environment within which change is occurring.

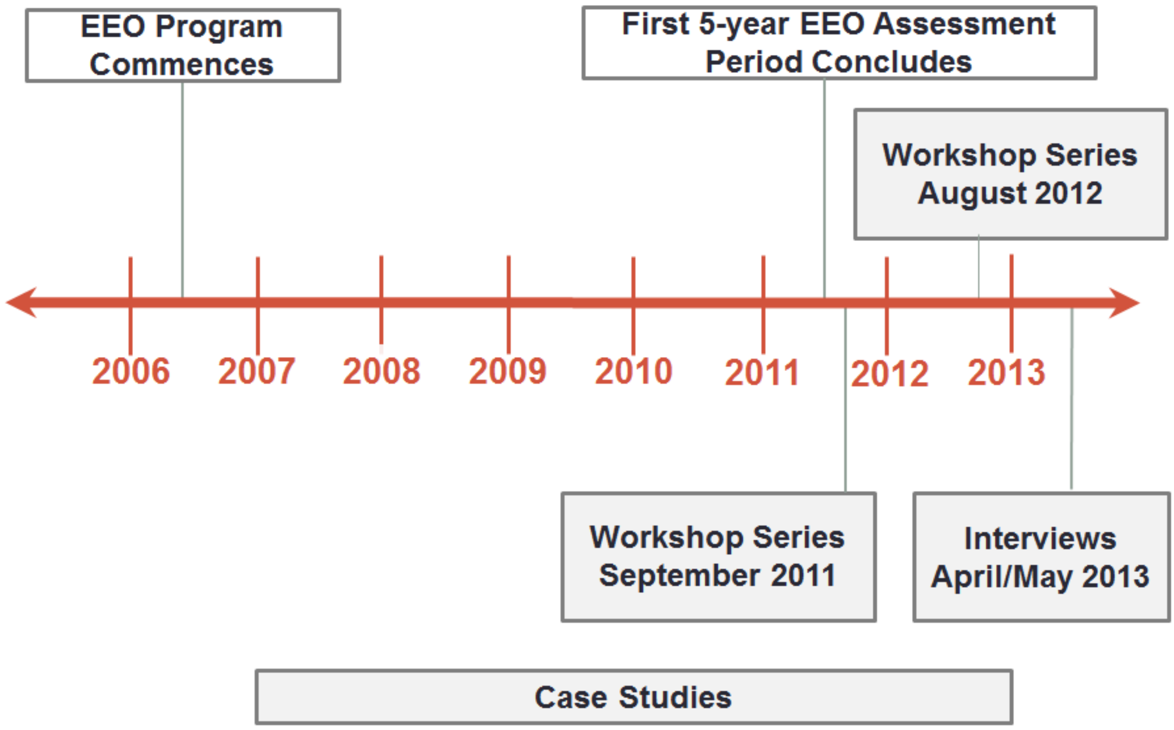
Framing the research as a single case does not limit the intention to conduct multi-level analysis at the field, organisational and project level. Yin (2003, p. 43) characterises this approach as a single case study using an embedded case study design. Additional levels of analysis are considered units of analysis that are embedded within the broader case as a whole. Each of the organisations involved may be considered an embedded unit of analysis, as are the corporate energy practitioners and projects themselves. There are many other units of analysis that could be examined in this research. However, the challenge here was to analyse different units of analysis at a suitable level of abstraction that allowed local differences to be addressed (Platt 2007) and, ultimately, to respond to the primary research question. Such complexity presents a choice to the researcher between locally relevant detail and the wider, field-level analysis being undertaken in the research. The need to limit the scope of the analysis is ultimately a 'limitation' of the analysis. For example, analysis could occur based on the different industry sectors. While outlying examples and obvious differences will be described, the study aims to identify commonalities at the level of the field, rather than detailed nuances that may occur from one organisation to the next. These are acknowledged limitations, yet this level of analysis is appropriate to the aim of the case study to challenge existing approaches and theoretical assumptions applied in the body of energy efficiency literature.

This research acknowledges the challenges and, at a practical level, aims to highlight the broader shifts (patterns) occurring at the level of the field, provide illustrations of the implications at the organisation and project levels and, in cases where there are distinct outliers, to make this clear. (Further complexity is apparent in that the aim is to capture the process of change over time.) Inevitably, there will be a loss of locally relevant detail, but the broader research aim/question is presented as an important focus throughout the research, which means that there is an emphasis on the wider, field-level trends, as illustrated by the local organisational and project-level interactions.

The case is also bounded by physical location and time. The case is confined to the energy used by large energy consuming organisations in Australia and the period 2006–2012. The case study period begins with the introduction of the first national energy efficiency legislation in Australia that requires organisations to conduct energy efficiency assessments. This would have an impact on the largest energy consuming firms. It may be considered a significant event that was common to all of the organisations involved in the study. It also explicitly aimed to influence energy efficiency practices in firms using a regulatory framework that included penalties for non-compliance. Another advantage of this timeframe was that it provided a clear milestone that practitioners could refer to (as they did) in their presentations (i.e. Here is how we did things before the introduction of EEO legislation … Here is how we first approached the EEO legislation … Here is how and why we changed our approach).

The EEO legislation is structured around five-year assessment cycles. A formal requirement is for firms to report to the government on the approach that they intend to take in conducting their energy efficiency assessments and reporting. This structure of the program has also encouraged firms/practitioners to formally review their approach at the commencement of each five-year assessment cycle which concluded (for most firms) in July 2011 – providing another milestone. This corresponded with the topics of the conference presentations (i.e. reflection over the five years about what worked well and what did not, and projections forward about future activities and the reasons for these). The timeframe covered by the case study and the timing of data collection is shown in Figure 6.2.

Figure 6.2:Timeframe of the case study showing data collection points



This particular case is being used for a number of reasons. It provides a clearly bounded period of time in which there is evidence that a number of organisations have modified their energy management practices. This was the first time the Australian Government had introduced national legislation making it mandatory for large energy users to conduct rigorous and comprehensive energy efficiency assessments and to report publicly on the outcomes from those assessments each year. This provides a unique data set that offers an opportunity to expose the limitations of dominant theories associated with explaining the phenomenon of the energy efficiency gap. Therefore, the case may be considered to be a ‘critical’ case (Yin 2009). The case is ‘revelatory’ in that there have been few studies that examine how corporate energy management practices change over time, and the underlying dynamics contributing to such change. Single case studies are appropriate to refocus investigations in a particular area of investigation (Yin 2009).

6.3.2 Theoretical sampling

The sample of organisations used in this study was selected for their theoretical interest rather than as a means of sampling within a population with the intention of generalising to the wider population (Eisenhardt 1989; Meyer, Gaba & Colwell 2005). Since the focus on changing practices was sought, it was considered appropriate to look for theoretical exemplars (Flyvbjerg 2006; Van de Ven 2007). Thus, organisations were sought that were able to demonstrate – with a high degree of experience – the phenomena of changing energy management practices (the focus of the study). It is important to note that the exemplars being sought were not necessarily based on a preconception of 'ideal energy management practices', as may be the case if a variance approach was being used. Rather, organisations for which there was evidence to suggest that energy management practices had *changed* over the study period were sought.

Drawing on public presentations by corporate energy practitioners presented a number of important benefits in relation to the type and number of organisations selected for the study. The focus of the conference setting was one in which presenters were encouraged to describe how energy management practices had changed within their organisation, including current challenges and future opportunities. Therefore, the conference presentation topics and events were aligned with the research questions and provided access to data about a relatively large number of organisations. It was expected (and later borne out in the analysis) that organisations choosing to present at such a public event would have experience of change which they would be willing to share. Thus, this source of data was an effective and efficient way of obtaining data from a large number of organisations that had 'self-selected' as organisations in which management practices had changed. Since these organisations had already presented information in the public domain, access to corporate energy management practitioners for interviews was also facilitated.

Access to data from a relatively large number of organisations presented both challenges and opportunities. For example, data from a larger number of organisations increased the time required for analysis. The larger sample meant a degree of granularity was traded off against the strength in observing the patterns of change that were common to many of the organisations in the study, and those areas of change in which there was greater heterogeneity (Van de Ven 2007). Further, selecting organisations and corporate energy practitioners with the experience to reflect on the state of energy management practices retrospectively (i.e. back to 2006) and prospectively was a valuable criterion in the selection of data and research participants.

6.4 Data sources

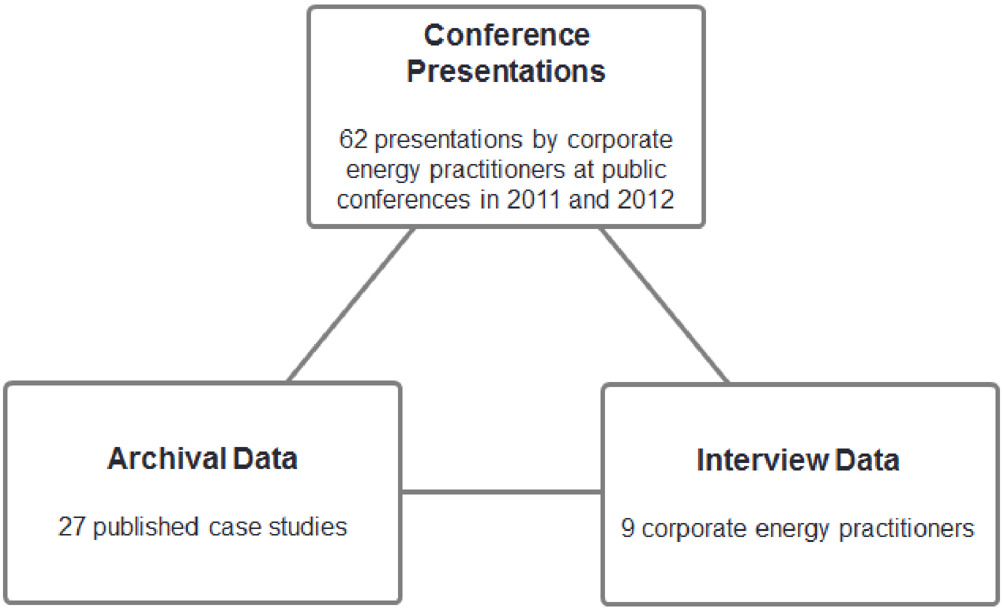
Three distinct data sources were drawn on for this research:

1. conference presentations
2. interview data, and
3. archival data (see Figure 6.3).

Drawing on data from multiple sources allows for the research findings to be compared across the different data sources in order to identify consistencies and inconsistencies. This is known as data triangulation and is an important strategy for enhancing the construct validity of the research (Punch 2005; Yin 2009). By using multiple data sources, the inherent limitations of each data source can also be reduced.

It is important to note that while each source of data reflects individual perspectives, the extent to which each is influenced by corporate rhetoric will vary. For example, corporate influence is likely to be strongest in the published case studies since the process of developing material that will be available to the public in a more permanent sense, involves multiple iterations and reviews by corporate personnel within the case study company. Relatively less corporate public relations influence is likely to exist in the conference presentations. The nature of the conference events – which involved an audience of other corporate energy practitioners (peers) operating within a ‘community of practice’ is likely to have minimised corporate rhetoric. Finally, confidential interviews are likely to have reflected less corporate messaging and stronger individual perspectives since comments by respondents were de- identified. Therefore, the use of multiple sources of data helps to reduce the influence of corporate rhetoric that would be difficult to identify if only one source of data was used.

Figure 6.3: Three distinct data sources support triangulation



6.4.1 Conference presentations

The primary data used within this thesis is drawn from public presentations made by experienced corporate energy practitioners at annual energy efficiency conferences hosted by the Australian Government Department of Industry (Department of Industry).The aim of the conferences was to provide a public forum in which energy practitioners could:

- share experiences associated with improving the energy efficiency performance of their organisations
- deliver beneficial business outcomes, and
- support organisations in meeting their compliance obligations under the EEO legislation.

The energy efficiency conferences took place in August and September in 2011 and 2012. They were held in the cities of Brisbane, Melbourne, Sydney and Perth. Each year, approximately 600 energy efficiency practitioners attended the conferences.

Meyer, Gaba & Colwell (2005, p. 467) define 'conferences' as being settings in which: "people from diverse social organizations assemble temporarily with the conscious, collective intent to construct an organizational field". Conferences provide an opportunity for emerging practices to be shared, discussed, contested, defined and refined amongst participants (Garud 2008). Lampel and Meyer (2008, p. 1026) characterise conferences as "field-configuring events" which they define as:

> "… temporary social organizations such as tradeshows, professional gatherings, technology contests, and business ceremonies that encapsulate and shape the development of professions, technologies, markets, and industries (Meyer, Gaba & Colwell 2005). They are settings in which people from diverse organizations and with diverse purposes assemble periodically, or on a one-time basis, to announce new products, develop industry standards, construct social networks, recognize accomplishments, share and interpret information, and transact business."

Field-configuring events provide important insights into the dynamic changes associated with the emergence and development of institutions. For researchers, they provide important opportunities to observe change 'as it happens', providing a unique view and perspective from actors as they interact with others. Such events can act as drivers for change and also represent the outcomes from change (Lampel & Meyer 2008). With regard to research on the energy efficiency gap, the use of data from these events also responds to the call for non-traditional research methods to be applied in order to contribute new knowledge and understanding (Palm & Thollander 2010).

The energy efficiency conferences are a relevant example of a field-configuring event associated with institutional changes related to the development of energy management practices. Table 6.3 shows how these annual energy efficiency conferences correspond with six defining characteristics of field-configuring events, as proposed by Lampel and Meyer (2008).

Table 6.3: Energy efficiency opportunities conferences as field-configuring events

	Characteristics of field-configuring events	Characteristics of the energy efficiency opportunities conferences
1	Actors from diverse professional, organisational and geographical backgrounds assemble in one location.	Conferences were held in five capital cities around Australia. Each conference included representations from a diverse range of industry sectors. In 2011, the conferences included sector-specific conferences for participants in the commercial, manufacturing, transport and mining sectors.
2	Limited duration, normally running from a few hours to a few days.	The conferences were held over two full days in 2011 and one full day in 2012. Around 600 people attended the conferences each year.
3	Provide unstructured opportunities for face-to-face social interaction.	The focus of the analysis is on the presentations made by industry representatives and questions posed by participants. However, the events themselves encouraged interaction amongst participants between sessions and during meal breaks.
4	Include ceremonial and dramaturgical activities.	Conferences commenced with a presentation by a senior official within the Department of Industry. On the first day of each conference, an industry panel session was held which provided conference participants with an opportunity to obtain perspectives from each of three corporate energy practitioners represented on the panels.
5	Are occasions for information exchange and collective sense-making.	This was defined as an explicit objective for the conferences.

	Characteristics of field-configuring events	Characteristics of the energy efficiency opportunities conferences
6	Generate social and reputational resources that can be deployed elsewhere and for other purposes.	The conferences provided opportunities for organisations to demonstrate energy efficiency leadership to government and other organisations. For government personnel, the conferences provided an opportunity to build relationships with participants and demonstrate the constructive intent of the EEO legislation and the willingness of government personnel to provide support wherever possible.

This conference setting presents a unique opportunity for corporate energy practitioners to share their experience and lessons learnt about energy management with other practitioners. In doing so, the practices that they shared and the logic associated within them, can be expected to have influenced the extent to which such practices were considered legitimate in the eyes of regulators and other influential field constituents (e.g. other large energy consuming organisations and energy consultants). Contested issues were also presented and discussed at the conferences. Although the resolution of contested issues did not necessarily occur at the conferences themselves, the opportunity for such issues to be aired and discussed may be considered to contribute towards resolution across the organisational field associated with energy management practices.

Presentations by experienced corporate energy practitioners were a central component of the conferences. Box 6.1 explains the rationale for using the term ‘corporate energy practitioner’ throughout the case study and the common characteristics of presenters and interviewees. The Department of RET provided an open invitation to all organisations with obligations under the EEO legislation. The invitation and brief described the objective of the presentations as being to describe the experiences within the company regarding what they had achieved and how they had approached energy efficiency improvement. Presenters were asked to share their perspectives on how their companies had approached energy efficiency since 2006, ‘lessons learnt’, how the energy efficiency and change management practices had and had not worked for them, and what they planned to do differently in the future. 6 presentations from consultants were also included in the analysis. In each of these cases the consultants were describing specific case examples of work with long-term clients.

The presentations were between 15–20 minutes long and were followed by question and answer (Q&A) sessions from participants. Audio recordings were made of the presentations and Q&A sessions. The audio recordings were transcribed and the transcriptions were then made available to the researcher by the Department of Industry for analysis in this research on the basis that individuals could not be directly identified. Transcripts from these Q&A sessions were also included in the analysis.

Presenters represented a range of industry sectors. The number of presentations that were used for the analysis (based on conference location) are shown in Table 6.4 and (by industry sector) in Table 6.5. A complete list of presentations, including the industry sector and job title of the presenters is provided in the Appendix Section 11.4.

Box 6.1: Characteristics of 'corporate energy practitioners'

The term 'corporate energy practitioner' is used throughout the case study to describe the research respondents involved in both conference presentations and interviews. A number of other terms were considered, such as energy manager or sustainability manager. However, it was found that there was a great deal of variation between the job titles of the respondents and some differences in their professional backgrounds. Therefore, it was determined that a new term was appropriate. The shared characteristics of 'corporate energy practitioners' (as this thesis defines them) are that they:

- have a corporate role in a large energy consuming organisation
- are responsible for improving the overall energy efficiency performance of their organisation and ensuring that legislative requirements are met, and
- have visibility and influence across multiple operating sites within their organisation. This might include factories, buildings and mobile fleet (e.g. trucks/cars).

Corporate energy practitioners may have broader roles associated with operations, environmental management or corporate sustainability. However, to be considered a corporate energy practitioner, each of the three points listed above will have been demonstrated.

Table 6.4: Conference locations and dates

Location	Conference dates	Number of presentations analysed
Brisbane	31 August 2011–1 September 2011	8
	23 August 2012	8
Sydney	7–8 September 2011	8
	28 August 2012	7
Melbourne	14–15 September 2011	8
	30 August 2012	8
Perth	28–29 September 2011	8
	6 September 2012	7

Table 6.5: Number of presentations by industry sector*

Industry sector	Number of presentations
Commercial buildings	14
Manufacturing	22
Mining	17
Multi-sector	3
Transport	5
Utility	1
Total	**62**

*Sectoral definitions are based on the titles used by the Department of Industry at the 2011 conferences.

6.4.2 Interview data

The purpose of conducting interviews to obtain data was to obtain insights into *how* and *why* energy management practices had changed by drawing directly on the perspective of experienced practitioners. In comparison to the data obtained through public presentations, interviews provided a more private setting in which it was made clear to respondents that confidentiality would be maintained. This provided an opportunity to validate the information that had been provided in public, as well as to explore specific areas where deeper perspectives were sought.

The aim of an interview informs the structure (Cassell 2009). In order to obtain an historical perspective it was decided that the interviews would follow a semi-structured format. This encouraged the respondent to reflect not just on their present experience, but also to reflect on their past experiences. The first level of structure in the questioning was formed around their recollection of how energy was managed in historical phases (i.e. prior to 2006) and then through to the present time. A degree of structure was useful to reduce the time required for the interview without compromising the outcomes sought (Bell & Bryman 2007). The structure also enabled a greater level of comparison across respondent's answers, although this requirement was balanced against the priority of accessing respondents experience and perspectives (King 2004).

The interview context has an influence on the data that is gathered, the way it is interpreted and the conclusions that a researcher draws from the data (Fontana & Frey 2008). It is important to carefully consider the power relationship associated with the interview process.

The researcher aimed to present the research process as one in which there were shared benefits (Cassell 2009). For example, the researcher/interviewer obtained the benefit of conducting the research while the interviewee had the opportunity to share their perspective and to influence the research outcomes. Respondents saw benefits in providing information that would progress an issue that they felt personally passionate about. For this research, the researcher/interviewer was known to the respondents through previous research and activities, such as facilitating conferences at which respondents had participated as presenters. An advantage of this familiarity may be that the respondents are more open and willing to provide perspectives that they may not otherwise have shared. A potential limitation of the interview and the experience of the interviewer is that of tacit knowledge (i.e. respondents may not share information that may be assumed to be already known by the researcher) (Ylijoki 2005).

Interviewees were selected on the basis that they had presented information at the public conference events or had contributed to public material that was available in the public domain. All interviewees had three years or more experience working with an organisation in which they had facilitated the introduction of new energy management practices. The sample was initially segmented by industry grouping to obtain a range of perspectives across industry sectors. A list of interview respondents is provided in Table 6.6. The job titles have been modified slightly in order to maintain confidentiality. Interview questions reflected the model developed in the Chapter 5 (see Section 5.8). These questions are listed in Appendix Section 11.4.

Table 6.6: List of interview respondents

Identifier	Job title	Industry sector
Interviewee CK	Sustainability Manager	Commercial
Interviewee CL	Principal Climate Change and Energy Efficiency	Mining
Interviewee CM	Climate Change & Resource Efficiency Manager	Multi-sector
Interviewee CN	Business Development Manager	Transport
Interviewee CO	Environmental Manager	Transport
Interviewee CP	Project Manager Energy Efficiency	Manufacturing
Interviewee CQ	Principal Energy Advisor	Mining
Interviewee CR	Principal Energy Efficiency Engineer	Manufacturing
Interviewee CS	Carbon and Energy Manager	Mining

Prior to conducting the interviews a protocol was developed and reviewed by the University of Technology, Sydney Human Research Ethics Committee. The protocol outlined how respondents would be contacted and the way in which the interviews were to be conducted. The steps taken are set out below:

1. The researcher called the head office of the proposed respondent to explain the purpose of the research and to request an interview. In cases where the call was diverted to an answering machine, a message was left.
2. An email was then sent to potential respondents with further detail on the research, including a copy of the consent form that the respondent would be required to complete before the interview could proceed.
3. Questions were sent to the respondent so that they could reflect on the questions prior to undertaking the interview (if they wanted to).
4. A mutually agreed time was agreed on to conduct the interview.
5. The researcher called the respondent at the allocated time and conducted the interview. The length of the interviews varied from 30–60 minutes.

6.4.3 Archival data

Archival data was drawn from case studies that were developed and published by the Department of Industry (known at the time as the Department of Resources, Energy and Tourism). Some were stand-alone case studies while others were incorporated into broader documents which provided guidance on how to conduct energy efficiency assessments effectively and how to meet the requirements of the EEO legislation. The case studies are listed in Table 6.7. All case studies were publicly available at the time of writing. Weblinks are listed for each case study in Appendix Section 11.4.

As discussed previously, a limitation of written case studies as a data source is that they may have been sanitised through the development of multiple iterations prior to finalisation and therefore they may be highly reflective of corporate influences and messaging. At the same time however, such iterations can enable key lessons learnt about changing energy management practices to be more carefully refined and clearly articulated.

Table 6.7: Archival data: Case studies

Identifier	Organisation	Industry sector	Year
Case CT	Fortescue Metals Group	Mining	2011
Case CU	Fortescue Metals Group	Mining	2012
Case CV	Downer EDI Mining Pty Ltd	Mining	2012
Case CW	Leighton Contractors Pty Ltd	Mining	2012
Case CX	Thiess Australia Mining	Mining	2010
Case CY	OneSteel	Manufacturing	2010
Case CZ	Nyrstar – Port Pirie Smelter	Manufacturing	2010
Case DA	Midland Brick	Manufacturing	2009
Case DB	Incitec Pivot	Manufacturing	2009
Case DC	Alcoa Pinjarra	Manufacturing	2008
Case DD	Xstrata Copper	Manufacturing	2007
Case DE	Orica	Manufacturing	2007
Case DF	Bunker Freight Lines	Manufacturing	2008
Case DG	Woolworths Limited	Commercial	2012
Case DH	GPT Group	Commercial	2012

Identifier	Organisation	Industry sector	Year
Case DI	Spotless Integrated Services	Commercial	2012
Case DJ	National Australia Bank	Commercial	2012
Case DK	Sydney Water	Commercial	2012
Case DL	Simplot Australia	Commercial	2012
Case DM	The Foster's Group	Manufacturing	2012
Case DN	Centennial Coal	Mining	2012
Case DO	Downer EDI Mining Pty Ltd	Mining	2012
Case DP	Newmont Asia Pacific	Mining	2012
Case DQ	Rio Tinto Iron Ore	Mining	2012
Case DR	Australia Post	Transport	2012
Case DS	Linfox	Transport	2012
Case DT	Ron Finemore Transport	Transport	2012

Notes:

- The researcher authored Case CX and co-authored Cases DG to DT with Dr. Helen Lewis under contract with the Department of Industry in 2012.
- There are two distinct case studies for Downer EDI Mining Pty Ltd.

6.5 The analytic process

One of the challenges of case study research is that it can involve the analysis of large amounts of data (Yin 2009). Further, being immersed in a case can 'make everything interesting' which requires the researcher to carefully analyse the comprehensive set of data that is available to them (Siggelkow 2007).

An important way in which the large quantity of data was managed in this thesis, involved conducting three distinct cycles of analysis. Each cycle corresponded with the time at which the research data was available. These distinct cycles of detailed data analysis were interspersed with periods of reflection and ongoing review of the literature (Dawson 2003). Following Miles, Huberman & Saldaña (2013), each cycle involved three concurrent flows of activity:

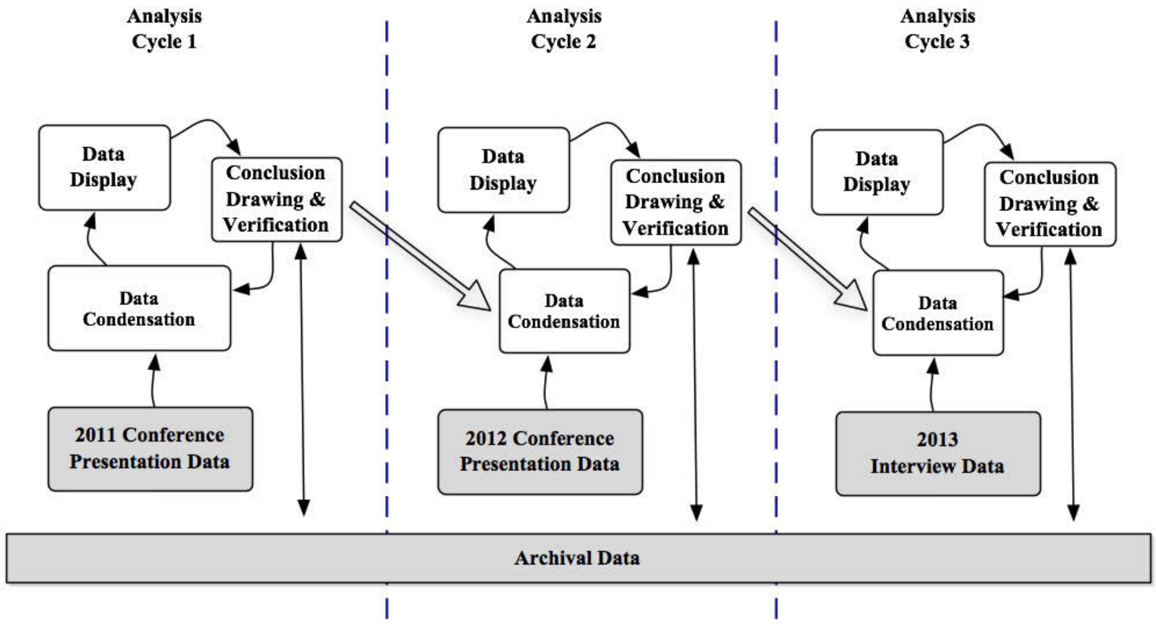
1. data condensation
2. data display, and
3. conclusion drawing and verification.

Figure 6.4 illustrates the progressive and iterative process by which these three streams of analytical activity have been applied within the present study. In the first analytical cycle, the archival data (case studies) and transcriptions of the conference presentations made by corporate energy practitioners in August 2011 were analysed. The presentation data was transcribed and entered into the NVivo Qualitative Analysis Software program. The data (from the published case studies and presentations) was condensed by systematically transforming the raw data through a process of selection, simplification and abstraction.

Analytical techniques, such as content analysis and temporal bracketing, were conducted. Data displays using visual mapping techniques were then applied in order to describe emerging relationships between energy management practices, stakeholders, influencing strategies and the changing constituency of the organisational field. Initial conclusions were then drawn from the data and verified against the archival data (i.e. published case studies). Conclusion drawing and verification involved drafting notes and developing explanations based on each data analysis cycle. Causal flows and propositions were also developed. This approach was then repeated approximately 12 months later with the data from the August/September 2012 conference presentations (analysis cycle 2) together with additional written case studies that were published over this time. Finally, in April and May 2013 the interview data was incorporated into a third and final analysis cycle with the newly obtained data from the interviews.

Figure 6.4: An interactive and progressive model of data analysis

(Source: Adapted from Miles, Huberman & Saldaña 2013, p. 14)



As well as addressing the challenge of 'data overload', it is expected that the episodic approach to data analysis improved the quality and validity of the analysis by providing periods of reflection, ongoing review of the literature and further development of the theoretical framework that was applied in the study. During the periods of time between each cycle of analysis, the researcher was also involved in many informal discussions with corporate energy practitioners, policymakers, academics and students. This contributed towards the process of exploring and validating propositions and conclusions that emerged through the study. An additional advantage of this progressive approach was that various conference papers and presentations were developed which enabled the outcomes of analysis to be tested within the community of energy efficiency academia, policymakers and practitioners. These publications are listed in Appendix 11.1.

Further, multiple analytical techniques were used to minimise the limitations of a single approach (Langley 1999, 2009), which provided the additional benefit of viewing the research from different perspectives. Four analytical approaches were used to develop the case study:

1. content analysis
2. visual mapping
3. temporal bracketing, and
4. narrative strategy.

Each of these analysis techniques are described in sequence.

6.5.1 Content analysis

Content analysis, an interpretative research technique that examines recorded human communications (Babbie 2013), was the primary technique applied to achieve data condensation. Data condensation involves transforming the raw data through selection, simplification and abstraction (Miles, Huberman & Saldaña 2013). The aim of data reduction is to minimise the quantity of data while maintaining relevant information and the context that informs that data (Punch 2005).

Content analysis was conducted by first entering the raw data from conference presentations and interviews into NVivo data analysis software. This software aids the analysis process by facilitating sorting of data into particular codes (Punch 2005). Codes are labels that are assigned to 'chunks' of data (Miles & Huberman 1994) or 'strings of words' that provide particular meaning.

The mode of inquiry combined induction with deduction. Predetermined coding categories were established at the start of the coding process. The initial categories were informed by the research questions and the theoretical framework that was based on institutional entrepreneurship theory. This provided an operational template to guide the coding process at the broadest level. Data condensation was achieved by identifying and recording strings of words (Van de Ven 2007) that captured information about:

- energy management practices
- the social context that influenced those practices,
- the stakeholders involved in influencing changing practices, and
- the strategies that were used by stakeholders to influence change.

Each high-level code was then analysed at different levels of analysis and in relation to time. The high-level codes and sub-codes are listed below in Table 6.8.

Table 6.8: Descriptive codes applied at the start of the coding process

Code	Sub-codes
Social context	• Organisational Field, Organisation or Project level
Energy management practices	• Past, Present or Future • Organisational Field, Organisation or Project • Strengths and Limitations
Stakeholders	• Organisational Field, Organisation or Project level
Change strategies	• Direct influence • Interactions with other actors

Within each of these broad coding categories, multiple sub-categories were developed. Often this involved an 'inductive' approach to the analysis. Induction refers to inferences that are drawn directly from observations within the data (Miles, Huberman & Saldaña 2013).

Coding was based on the theoretical model developed in Chapter 5 (see Section 5.8). At first, the coding was highly descriptive and involved little interpretation. As the coding process continued, however, and the researcher identified more complex issues, the coding became more interpretive and involved analysing more complex social dynamics such as the interactions between corporate energy practitioners and key external stakeholders. Further familiarity with the data then allowed for 'pattern codes' to be identified. Pattern codes are more inferential and explanatory than descriptive or interpretive codes (Miles & Huberman 1994). Pattern codes include examples of causal dynamics across the organisational field, organisational and project levels of analysis.

6.5.2 Temporal bracketing

Temporal bracketing is a form of content analysis. It involves the development of units of analysis based on time periods which are used to structure events (Denis, Langley & Cazale 1996; Langley 2009). Temporal bracketing enables comparative units of analysis to be developed in order to examine and replicate particular theoretical ideas (Langley 1999). One advantage of this approach is that a mass of data can be organised into separate blocks of data that are, nevertheless, connected.

Evidence can be drawn together within a particular period to describe relative stability of change processes, how context affects them and what consequences there might be for future periods (Langley 1999).

To support temporal bracketing, critical incidents and events were first sorted into chronological order to enable comparison. As described previously, 2006 was adopted as a starting point since this year marked the introduction of the EEO legislation. This formed a useful starting point for the case study for three main reasons:

1. The legislation specifically aimed to influence energy efficiency practices across large energy-using firms in Australia and, therefore, provided a widespread and substantial trigger for energy management practices to change.
2. The year 2006 also marked the beginning of a number of critical drivers for energy efficiency as the EEO legislation came into force. Subsequent years saw the acceleration of other drivers for change, including other energy and climate-related legislation, as well as increases in energy prices.
3. Since the corporate energy practitioners involved in the study were responsible for energy management when the EEO legislation was introduced, it provided a clear historical trigger which helped them to recollect the energy management practices in place at that time and the changes that had occurred since commencement of the EEO legislation.

Once critical incidents and events were sorted into chronological order, they were then sorted into three phases:

1. The first phase reflected the energy management practices that organisations applied as they began to respond to the EEO legislation. By establishing the energy management practices being enacted at this time, the first phase acted as a baseline against which comparison of changes to energy management practices could be made.
2. The second phase captured the period of transition in which energy management practices were modified.

3. The third (and final) phase attempted to capture efforts by organisations to maintain energy management practices that had developed in the second phase.

Aside from the established starting year for the analysis, there was no attempt to overly specify the temporal boundaries for each of these phases as it was expected that there would be a high degree of variation from one phase and one organisation to another. The aim was to identify broad trends including the typical sequence of practice development over time.

6.5.3 **Visual mapping**

Visual mapping involves the representation of data in diagrams, tables and other forms of visual displays (Langley 1999, 2009; Miles & Huberman 1994). An important advantage of visual graphical representations in process studies is that they allow for the display and analysis of data that is multi-dimensional and can help to clearly show the ordering of activities, parallel processes and change over time (Van de Ven 2007). Accordingly, visual displays support the development and testing of data and theoretical ideas (Langley 1999; Miles & Huberman 1994).

A range of visual mapping techniques is used in this thesis. One of particular significance is the development of causal networks. These are displays that aim to illustrate the way in which one variable influences another (Miles & Huberman 1994). In this research, these techniques are primarily used to illustrate the key factors that reinforce traditional practice and the process by which structural change in the field occurs. The entrance of new stakeholders in the field, together with the actions of corporate energy practitioners, enable new and improved energy management practices to be initiated. Each visual display is supported by description in text.

In this research the development of causal networks provides several advantages:

1. Causal networks provide a means of identifying and representing patterns in the data. They are especially useful in presenting the various factors and consequences of traditional practices, as well as the consequences and flow-on effects of new practices.

2. They highlight the influence of changes in the constitution of the field and the interactions across different levels.
3. Finally, they can also help to capture complexity in an holistic manner (Sherwood 2002), thereby improving the accessibility of the research by practitioners and academic audiences.

6.5.4 Narrative development

To move from surface observation to theory testing and then development, it is necessary to progress from description to explanation. Drawing on the work of Pentland (1999), Van de Ven (2007) suggests that there are five key features of an effective narrative that supports process theory development.

1. A narrative should have a clear chronology, including a beginning, middle and end that allows for the actions referred to in a narrative to be understood as occurring in a sequence: In the present study, the beginning describes the way in which organisations responded to the trigger of new energy efficiency legislation in ways that reflected previously established energy management practices. The middle explains the change process and the end of the narrative describes actions being taken in an attempt to maintain the newly-developed energy management practices.
2. There is a focal stakeholder or stakeholders: In the present study, change is seen from the perspective of the 'corporate energy practitioner'. That label describes a person who has had responsibility for improving energy performance in large energy consuming organisations over the course of the study period. It is an explicit goal of the research to identify other stakeholders and to identify how they interact. The perspective of the corporate energy practitioner informs who these other stakeholders are, how they influence energy management practices and how they interact. As their role typically involves interacting between many internal and external stakeholders, the corporate energy practitioner as protagonist is considered to have insightful perspective on who these stakeholders are and how they influence the change process. However, it is acknowledged in the research that this is their perspective, as interpreted by the researcher and, as well as being a strength, the reliance on the informants involved in this role is not tested in this research by drawing on the perspective

of other stakeholder perspectives.

3. There is an 'identifiable narrative voice': In this research the case study is intended to be written in the voice of the corporate energy practitioner (as described above).
4. The narrative should provide an evaluative frame of reference: This refers to the need to draw out and the meaning and cultural values that influence the behaviour of individual and organisational actors.
5. The narrative should contain textual devices that describe the context within which action takes place and attributes of the characters involved: This includes the insertion of explanatory context which is required for a reader to understand and make sense of the narrative.

6.6 Summary

This chapter has described the key features of the research design, including the methodological assumptions that underpin the research, the reasons for and features of the embedded, single-case study design, the sources of data and the analysis techniques are applied in the research. Chapter 7 will commence the case study, first by providing important historical context.

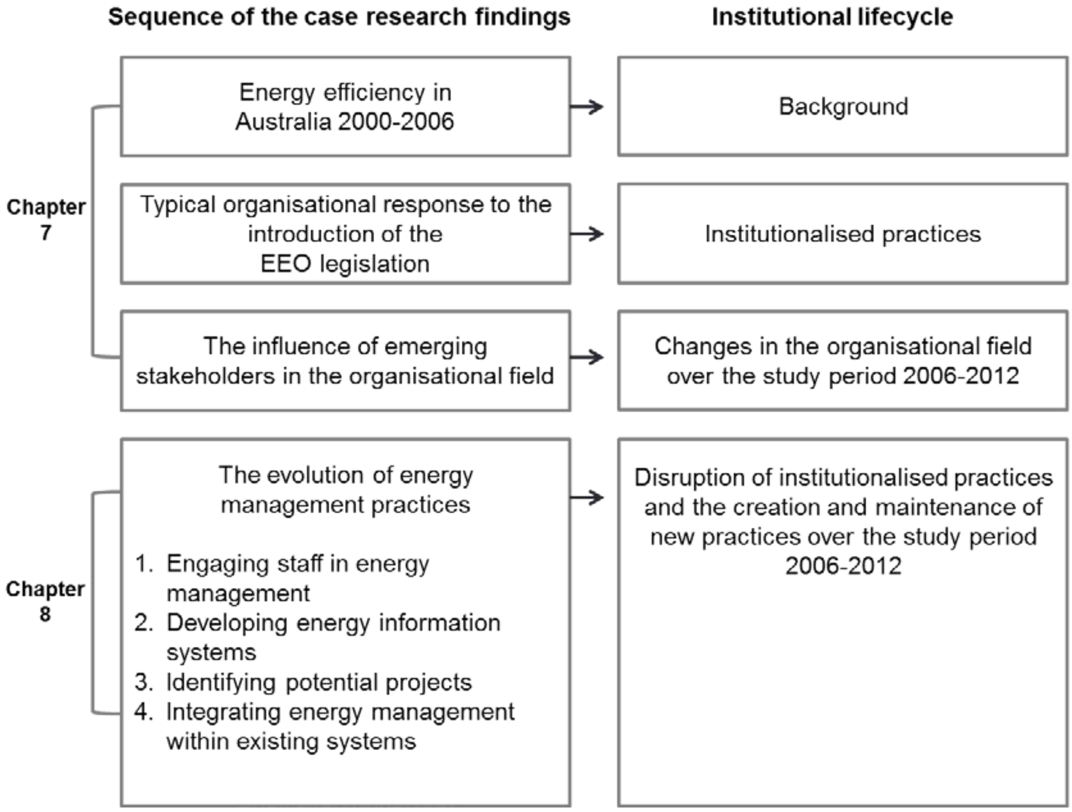
7. The genesis of institutional change

7.1 Introduction

This research describes the evolution of energy management practices in large energy consuming organisations in Australia between the years 2006–2012. It applies the three-level institutional change model (see Chapter 5, Section 5.8) to examine how and why energy management evolved from an activity that was largely managed by technical departments and focused on energy procurement and infrequent energy audits, to a more integrated and continuous process of energy efficiency improvement. The case study illustrates the way in which changes at the field, organisation and project levels interact to influence the development and adoption of energy management practices in organisations. It also examines the strategies that stakeholders have used to disrupt traditional energy management practices and to create and maintain new practices. There is a particular focus on the role of corporate energy practitioners (See Chapter 5, Section 5.8).

Figure 7.1 outlines the structure of the case research and how it corresponds with the institutional life cycle associated with energy management practices (i.e. the period over which energy management practices are disrupted, redeveloped and then maintained). The study begins by providing background information on energy use in Australia and the considerations that informed development of the EEO legislation. It then describes the institutionalised energy management practices applied by large energy consuming organisations as they first began to respond to their legislative obligations. In the final section of this chapter, changes in the organisational field associated with energy management practices over the study period are presented. Chapter 8 then describes the evolution of energy management practices in four key areas.

Figure 7.1: The case of changing energy management practices in Australia



In Chapter 7 and Chapter 8 references to primary data sources will be presented as footnotes. This approach will minimise disruption to the reader as there are a large number of references. The endnotes will contain source information relating to the presenter/interviewee status or the case study/name of organisation, individual position titles, industry areas and the year in which information was obtained. These references refer to prominent examples.

7.2 Background: Energy efficiency in Australia 2000–2006

Australia is an energy rich nation. In 2011, Australia was considered to be the third largest energy producing country in the world. In 2010–2011, 80% of energy production was exported. Reserves of thermal coal and uranium are estimated to fulfil current production levels beyond 2011. Current gas reserves are estimated to meet current production levels for 54 years. Although renewable energy sources contributed only around 10% of electricity production in 2010–2011, renewable sources of energy were considered to be 'abundant' (RET 2012c).

Primary energy use by Australian organisations (excluding electricity generators) account for around 46% of the energy consumed in Australia. A relatively small number of the largest energy-using corporations (252) account for approximately 65% of the total energy used by more than 100,000 Australian businesses (see Figure 7.2). The largest energy-using corporations operate in multiple industry sectors, including manufacturing, commercial, transport, mining and oil and gas (see Figure 7.3). The energy sources used and end-use activities are diverse (Department of Industry 2013).

Figure 7.2: Energy use in Australia: 2010–2011

(Source: Adapted from Department of Industry 2013, p. 9)

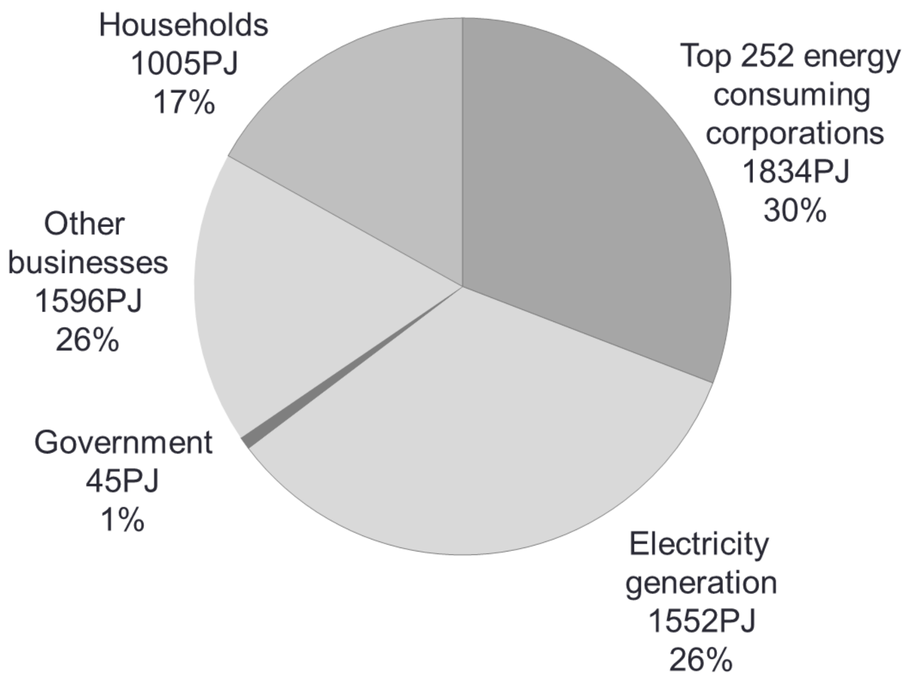
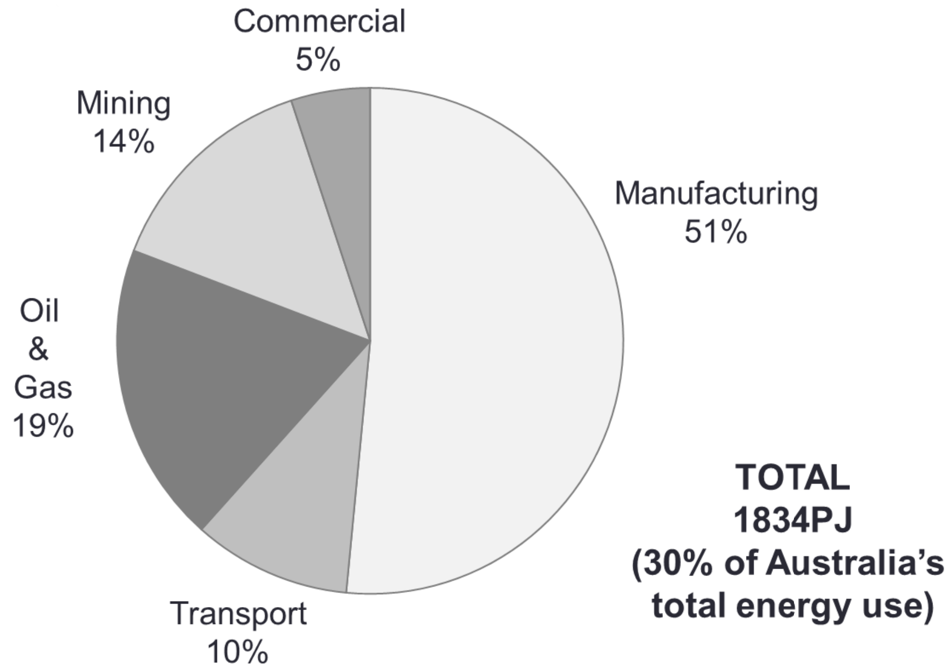


Figure 7.3: Energy use of the largest 252[9] corporations in Australia (2010–11) by industry sector

(Source: Adapted from Department of Industry 2013, p. 10)



The rationale for improving energy efficiency in large energy consuming organisations is outlined in the Australian Government's Energy White Paper titled *Securing Australia's Energy Future* (White Paper) released in June 2004. It is to: "increase economic welfare, lower the rate of growth in greenhouse emissions and delay the need for new energy generation equipment" (Commonwealth of Australia 2004, p. 106). The White Paper presented energy efficiency as an important priority. It highlighted that between the years 1973–1974 and 2000–2001, energy efficiency in Australia had improved by 3%. However, most of this improvement was attributed to a structural shift in the use of energy from energy intensive manufacturing towards less energy intensive service industries. The rate of energy efficiency improvement was shown to be less than half the rate of improvement in other countries in the Organization for Economic Co-operation and Development (OECD) group of countries. This relatively slow rate of improvement was presented as the

[9] While 319 corporations were registered by 2010-11, only 252 corporations were required to report in 2011.

rationale for the Australian Government playing a more direct role in encouraging energy efficiency improvement across the nation's economy.

New legislation was proposed in the White Paper to encourage improved energy efficiency in large energy consuming businesses. This was not the first time that the federal or state government had introduced energy efficiency programs. However, this was the first national legislation that required large energy users to conduct rigorous and comprehensive energy efficiency assessments and report publicly on the outcomes of these assessments each year. The EEO legislation had significant influence. As of 1 May 2012, there were 319 corporations participating in the program. At that time, the total energy use of these organisations accounted for 65% of the energy consumed by organisations in Australia (RET 2012b).

The White Paper outlined the reasoning behind the proposed legislation as follows (Commonwealth of Australia 2004, p. 113):

> *"To facilitate the uptake of these [energy efficiency] opportunities the government will require large energy users to undertake a rigorous assessment of energy efficiency opportunities every five years starting in 2006. These assessments will be undertaken consistent with an improved Australian standard and will be designed to identify energy efficiency investments with a payback of four years or less. Firms will be required to report publicly on the outcomes of the assessment, and will be free to make decisions on investments identified via their normal business processes. The government will act to ensure the assessments are rigorous and comprehensive, and to disseminate the lessons learned to the wider business community. Public reporting will be designed to provide the markets with useful information while protecting firms' reasonable commercial interests. Details of the regime will be developed in consultation with relevant stakeholders."*

The wording of the announcement reveals some of the sensitivities between the government and the organisations that would be affected by the legislation. For example, firms maintained discretion over the decision to implement the identified energy efficiency measures. This was in response to industry concerns about the government being prescriptive in relation to organisations' investment decisions. Also, by explicitly requiring consultation regarding the details of the legislation, organisations would be able to provide input to and influence the development of the legislation. Details regarding the assessment requirements were of particular concern to companies because the design of this aspect of the legislation could influence the level of resources required to meet compliance requirements.

Following the release of the White Paper, a team within the (then) Department of Industry, Tourism and Resources (DITR); subsequently known as the Department of Resources, Energy and Tourism (Department of RET) and at the time of writing known as the Department of Industry, was tasked with the role of managing the consultation process and developing the legislation. Although consultation was highlighted as an important aspect of the development process, the team began the task by drawing on their past experience of working with organisations on energy efficiency programs. For example, a number of the government personnel involved, including the lead manager, had been directly involved in the Energy Efficiency Best Practice (EEBP) program, which DITR had managed between the years 1998–2003. The genesis and design of the EEBP program provides useful insights into the energy management practices that were typically applied at the time, and the limitations of these established practices as perceived by the team drafting the EEO legislation.

7.2.1 Lessons learnt from the Energy Efficiency Best Practice Program[10]

The EEBP was a small voluntary energy efficiency program that operated between the years 1998–2003. It predominantly involved manufacturing organisations. The initial aim of the EEBP was to influence the uptake of energy efficiency in firms by

[10] The information in Chapter 7, Section 7.2.1 and Section 7.2.2 is drawn from an interview conducted by the author with the manager within the Department of RET who was responsible for the development and implementation of the EEBP program between the years 1998–2003 and the EEO legislation between the years 2004–2013. The interview was conducted by the author in September 2011 for the dual purpose of contributing to this thesis and developing a case study of the EEO legislation (written by the author and a colleague, Dr. Helen Lewis) that has been incorporated into the IEA publication titled *Energy Management Programmes for Industry: Gaining through saving* (Reinaud, Goldberg & Rozite 2012, pp. 58-62).

establishing energy use benchmarks that firms could access to compare their energy efficiency performance with other firms and energy efficiency 'best practice'. However, soon after the commencement of the program, it became apparent that benchmarking across Australian organisations was severely limited by a lack of quality energy data at the facility (e.g. the manufacturing site) and sub-system levels within firms. Industry feedback at the time also highlighted that organisations found it difficult to justify internal funding to install energy metering equipment and undertake analysis, since the benefits from investing in this equipment were often not sufficiently known to justify the costs involved.

Two new approaches to energy efficiency assessment were trialled through the EEBP program:

1. Best Practice People and Processes, and
2. Big Energy Projects.

Best Practice People and Processes involved establishing a facility-based energy management team that included participants across different functional and professional areas of a manufacturing site. The teams participated in a series of workshops in which they identified, evaluated and developed business case proposals for energy efficiency projects. Government funded training was provided along the way so that the teams collectively developed their skills in energy efficiency assessment and evaluation. Funding for the installation of energy meters was also provided where significant data gaps were identified. One of the projects at a dairy processing facility illustrates the success of the program. Through data analysis, discussion and business case development, the energy management team identified an opportunity to optimise boiler use by improving communications between the boiler operations area and shop floor staff. The project was estimated to save approximately AUD200,000 per year. It required little investment since it involved a procedural change, rather than equipment modification (Crittenden 2003). The involvement of staff from across the site was considered a key success factor in the program. The identification and implementation of projects (such as this) are typically difficult to achieve without collaboration and cross-organisational input.

The second approach, called Big Energy Projects, was a government funded program in which the firms involved were provided with resources to conduct a comprehensive analysis of energy data at the site. Data analysis techniques included examining energy and material flows and benchmarking equipment and processes against theoretical minimum energy use. The report from the data analysis was then reviewed during a two-day workshop with a cross-section of internal staff and external expertise. Stretch goals of more than 40% energy savings were pursued. Follow-up activity involved further evaluation of the opportunities that were identified in the workshop. In one case, the organisations involved identified energy savings in the order of 50% by fundamentally redesigning their plans for a new malting facility. When reflecting on their involvement in the program, key respondents acknowledged that the process helped them overcome commonly held assumptions in the industry about the way in which malting facilities should be designed and operated (Commonwealth of Australia 2002).

7.2.2 Consultation, trials and development of the EEO legislation

Based on the lessons learnt from the EEBP, the Department of RET developed a first draft of the EEO legislation. The consultation process for development of the EEO legislation commenced with an invitation for organisations to participate in a steering group. Twenty-six companies agreed to participate. These organisations were involved in one-on-one meetings as well as workshops in which they reviewed the early drafts of the legislation. Significant issues were identified and, with the input from these organisations, new drafts were developed and trials commenced.

The trials were designed to apply the legislation 'in practice' to identify issues and ways to improve the legislation. At the same time as the trials were underway, public consultation sessions with all interested and effected parties were held. The consultation process included the development and release of discussion papers, one-on-one meetings and, ultimately, an exposure draft of the legislation that organisations could review before it was presented to parliament. The four key mechanisms of the legislation that were designed to encourage energy efficiency improvement in firms through implementation of the EEO legislation are summarised in Table 7.1.

A detailed summary of the EEO Assessment Framework is provided in Appendix Section 11.3. The EEO legislation commenced on 1 July2006.

Table 7.1: Four key design features of the EEO legislation

Program mechanism	Firm obligations
Energy efficiency assessment	Organisations are required to conduct a rigorous and comprehensive assessment of 80% of their total corporate energy use once every five years. The EEO Assessment Framework, which is included in the regulations, defines the standard for these assessments.
Public reporting	Organisations are required to report annually on their energy use, assessments completed, a description of three significant opportunities, the number and associated energy savings of the identified opportunities and their business response to those opportunities.
External verification	The Department of Industry (formerly the Department of RET) conducts both desktop and detailed verification audits. The aim of verification is to ensure that the assessment is conducted in accordance with the EEO Assessment Framework and reported data is true and accurate.
Capacity building	Publications (e.g. guides, case studies) and annual conferences are provided to support organisations with implementation.

(Source: Adapted from RET 2011)

7.3 Typical organisational response to the introduction of the EEO legislation

One direct implication of the introduction of the EEO legislation in 2006 was that many organisations allocated responsibility for energy management to a corporate-level manager (referred to as a 'corporate energy practitioner' in this case study – see Chapter 6, Box 6.1) for the first time. This helped to elevate the importance of energy management, relative to other current and emerging business issues[11] and provide a central point of communication and accountability within these organisations on energy management issues.[12]

Traditionally, energy management had been considered the domain of engineering professionals due to their technical knowledge of operations and energy use.[13] However, since energy management had also become an issue of legislative compliance, many organisations deemed it appropriate for managers with experience in managing environmental legislation to coordinate their organisation's response to the EEO legislation[14]. Of the 62 presentations made by corporate energy practitioners at energy efficiency conferences organised by the Department of RET in 2011 and 2012, around half had professional backgrounds in engineering and the other half had environmental management backgrounds. This is an important and influential change brought about through the introduction of legislation that was designed to drive changes in energy management practices.

Reflecting on their experience of the early energy efficiency assessments conducted to meet the EEO legislation, corporate energy practitioners found (as described in both presentations and interviews) that there were a number of limitations associated with this approach to energy management. Figure 7.4 illustrates the interconnected characteristics of these limitations and shows how such limitations were reinforced at the organisational field, organisational and project levels. The figure is described below with examples provided by respondents that correspond to each of the numbered boxes in the diagram.

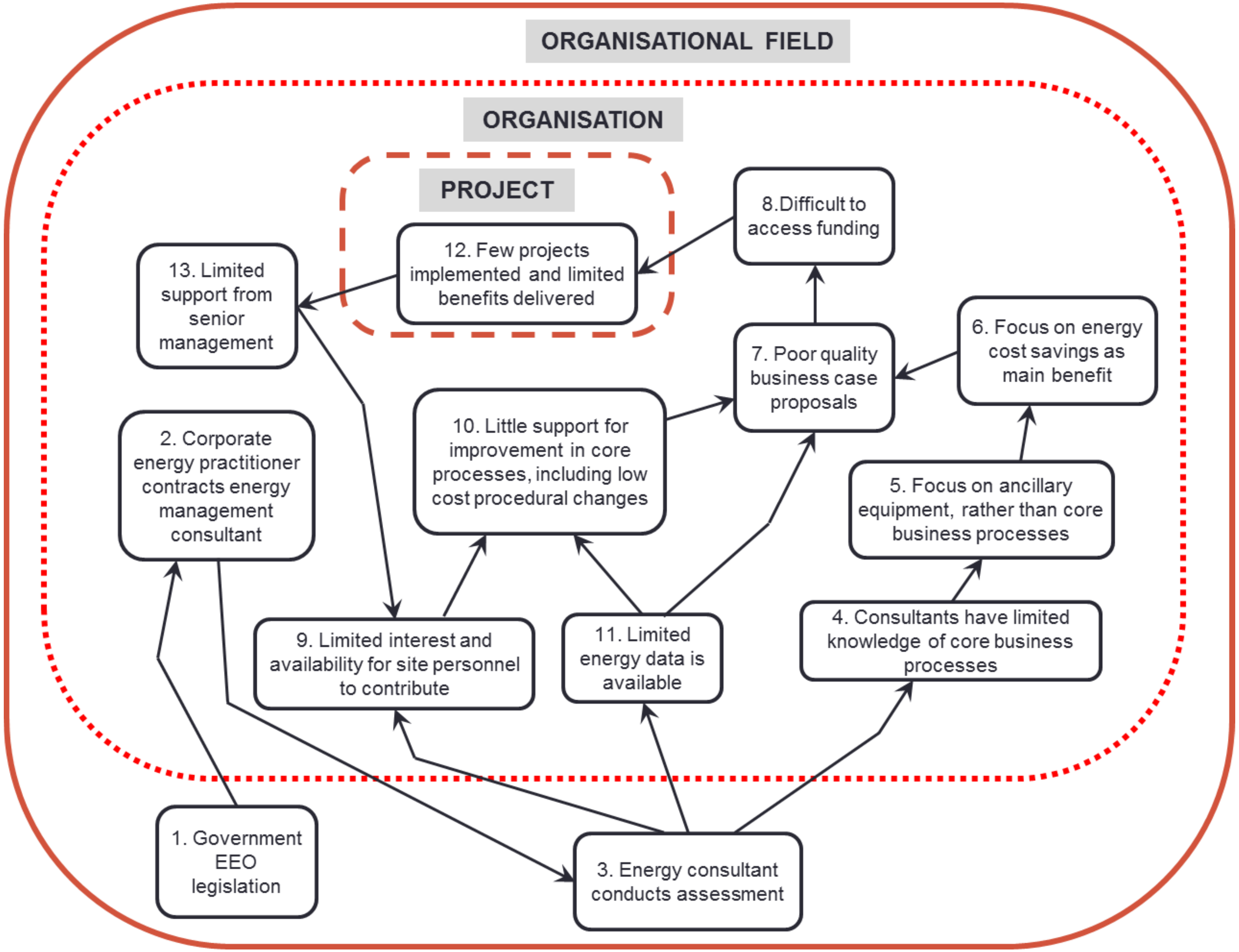
[11] Presenter BK Strategic Projects Manager Mining 2012

[12] Presenter BS Climate Change Manager Multi-sector 2012; Presenter BZ Environmental Systems Manager Manufacturing 2012; Presenter CB Technical Manager Manufacturing 2012

[13] Presenter BL Manager Sustainability Commercial 2012; Presenter BO Energy Analyst Manufacturing 2012; Presenter BS Climate Change Manager Multi-sector 2012

[14] Presenter AK Manager Climate Change & Environment Commercial 2011; Presenter BV Manager Resource Efficiency & Climate Change Manufacturing 2012; Presenter CD Environmental Sustainability Manager Commercial 2012

Figure 7.4: Limitations of traditional energy management practices



Even though corporate energy practitioners had varied backgrounds, the new and emerging role of the corporate energy practitioner exhibited distinct similarities from one organisation to the next. In the first instance, corporate energy practitioners were responsible for ensuring that the organisation met its legislative responsibility under the EEO legislation[15]. However, corporate energy practitioners found that when it was first introduced, the full implications of the EEO legislation were not well understood by managers, even as they were allocating staff or creating new positions to manage it. There was a tendency to assume that energy management was primarily a technical issue that should be managed in accordance with established energy management practices. As the Principal Energy Advisor in a mining organisation explained:

> "When I came on board in 2006 into my newly-created role, the sense was that we need to sort EEO out as it is a compliance thing. We know we need to do fourteen site audits. So, management just wanted me to 'make it happen'. It was very much seen as a technical exercise that would primarily involve the use of external consultants."[16]

The traditional 'energy auditing' approach applied by organisations as they conducted initial energy efficiency assessments to meet the requirements of the EEO legislation exhibited a number of similar characteristics and challenges. Underlying the approach, there were a number of assumptions about 'how energy management should be done'.

Table 7.2 summarises what the majority of respondents highlighted as key assumptions that were held when the initial energy efficiency assessments were being conducted under the EEO legislation.

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[15] Presenter CC Environment Advisor Manufacturing 2012; Presenter BL Manager Sustainability Commercial 2012; Presenter BN Carbon Policy Manager Manufacturing 2012

[16] Interviewee CQ Principal Energy Advisor Mining 2013

Table 7.2: Underlying beliefs that informed responses to the EEO legislation

Aspect	Underlying beliefs
Resourcing	External consultants seen to have the credibility and legitimacy to conduct energy efficiency assessments Outsourcing considered an efficient way of meeting compliance obligations since it would reduce the focus of staff on core operational issues[17]
Value	Considered an opportunity to reduce costs associated with energy use – for many organisations energy costs were considered a low proportion of overhead costs[18]
Time	Episodic – based on external reviews done every few years rather than continuous improvement[19]

First, organisations without sufficient in-house expertise assumed that external expertise in the form of external consultants was required to conduct the energy efficiency assessments. The use of external consultants was considered an appropriate approach since ‘outsourcing’ the assessment was expected to minimise disruption of the day-to-day activities of management and staff.[20] Second, the aim of an energy efficiency assessment was to establish a list of projects that could deliver energy performance improvements. The main benefit of such improvements was assumed to be cost savings associated with reduced energy use. Since energy efficiency projects often deliver other business benefits,[21] this meant that energy management was typically undervalued.[22] Third, this traditional approach also

[17] Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Presenter CD Environmental Sustainability Manager Commercial 2012; Presenter CG Manager Sustainability & Energy Manufacturing 2012

[18] Presenter AT Sustainability Analyst Manufacturing 2011

[19] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013; Interviewee CQ Principal Energy Advisor Mining 2013

[20] Interviewee CM Climate Change & Resource Efficiency Manager Multi Sector 2013; Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Presenter AB Chief Engineer Manufacturing 2011

[21] See Worrell et al. 2003 and the discussion in Section 4.5of this thesis for examples.

[22] Interviewee CK Sustainability Manager Commercial 2013; Presenter AC Energy Analyst Manufacturing 2011; Presenter AO Director Consultancy Commercial 2011

reflected assumptions about the appropriate time and attention made available to manage energy. Energy management was considered to be an activity that should be undertaken through episodic reviews every few years, rather than as a more frequent, continuous improvement type activity.[23]

According to respondents, there were a number of historic reasons why this approach to energy management was considered by many organisations to be the most appropriate way to manage the requirements of the EEO legislation. One of these reasons was that previous government energy management programs had promoted this approach; that is, they typically provided organisations with an external energy consultant who would undertake an energy efficiency assessment[24][25]. This approach had reinforced the idea that energy efficiency assessments were an appropriate practice and that external auditors with specialised expertise were the most appropriate people to conduct the assessment. This approach had also been incorporated into an Australian and New Zealand standard AS/NZS[26] 3598:2000 (Standards Australia/ Standard New Zealand 2000)which, in turn, further reinforced a particular approach to conducting energy efficiency assessments. Additionally, consultants in the energy management field were familiar with the energy audit approach and it was easier and more cost-effective for them to offer similar services to clients based on their own experience, even though their offerings did not necessarily correspond with the compliance requirements of the EEO legislation.[27] These underlying assumptions and the traditional 'energy auditing' approach that the majority of respondents applied to the first assessments conducted under the EEO

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[23] Interviewee CQ Principal Energy Advisor Mining 2013; Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Presenter AP Energy & Sustainability Manager Commercial 2011; Presenter AT Sustainability Analyst Manufacturing 2011

[24] Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Interviewee CS Carbon and Energy Manager Mining 2013; Presenter AE Energy Engineer Manufacturing 2011

[25] The term 'energy efficiency assessment' is often used interchangeably with the term 'energy audit' or energy assessment. Within this case study, the term 'energy efficiency assessment' has been predominantly used, except in direct quotations made by respondents.

[26] This standard was under review at the time of writing

[27] Interviewee CM Climate Change & Resource Efficiency Manager Multi Sector 2013; Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Presenter BV Manager Resource Efficiency & Climate Change Manufacturing 2012

legislation exhibited a number of limitations. The first limitation related to the skills and experience of external energy management consultants. They were generally found to be sufficiently skilled and experienced to support the identification of energy savings in equipment that was common to many different types of operations (e.g. pumps, motors and fans and other ancillary[28] equipment). However, the energy management consultants did not typically have detailed experience and understanding of site-specific production equipment and operational processes (see Boxes 4 and 5 in Figure 7.4). For example, a resource processing operation uses specialised crushers and grinders to extract ore from the dirt that has been mined. Consultants with *general* energy management experience would be able to identify opportunities associated with the pumps and motors supporting the process, but would not typically have sufficient knowledge of the specialised equipment that would allow them to propose energy efficiency improvement options associated with these core operational processes[29].

A further consequence of the focus on ancillary equipment and the limited experience of the energy management consultant would be that the cost benefit analysis would focus on the energy savings associated with a particular piece of equipment (e.g. a motor) without accounting for the influence that such a change might have on the whole production process (see Box 6 in Figure 7.4). For example, in some cases a motor replacement may lead to reduced breakdowns and improved control of the production process. However, such benefits typically would not be identified by the consultant and included in a business case proposal since the primary focus of the energy management consultant would be on identifying the financial savings from reducing energy use, rather than the wider productivity benefits. This means that the complete benefits that would reasonably be expected to accrue from a project would not necessarily be incorporated into a business case

[28] The term 'ancillary' refers to the energy using equipment that *assists* the main production process. Whilst energy savings in ancillary equipment are important, they may, in many cases, be relatively small when compared to the potential improvement opportunities available within the core production processes.

[29] Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Interviewee CS Carbon and Energy Manager Mining 2013; Presenter BV Manager Resource Efficiency & Climate Change Manufacturing 2012; Presenter CF Carbon and Energy Manager Mining 2012

proposal. This had the effect of limiting the quality of the business case proposals that would be presented to management for financial support (see Box 7 in Figure 7.4). Without a complete business case proposal, some projects that may have been considered feasible if they included more than just the energy saving benefits of a project, were potentially left unsupported[30] (see Box 8 in Figure 7.4).

A second limitation was that, since energy management consultants did not typically have detailed knowledge of a particular facility, this restricted their ability to communicate with and engage specialist internal staff in the process of identifying and evaluating energy efficiency projects (see Box 9 in Figure 7.4). This limitation is illustrated by a quote from a Carbon and Energy Manager in the mining/resource processing sector:

> "It can be very difficult [for the consultant] to be convincing and to really get people to understand the benefits of energy efficiency and to see the possibilities if the consultant can't talk to staff about their operating process in a detailed way. Often they can only talk about it on a superficial level."[31]

An attempt to overcome this lack of access to internal staff often led corporate energy practitioners to arrange a half to one day workshop for site personnel and the consultant/s. Typically approached as a 'brainstorming process' which encouraged a large number of energy efficiency improvement options to be identified, many corporate energy practitioners found that although a large number of *ideas* were identified in these workshops, they were frequently difficult to quantify and cost. Also, the resources required to scope and evaluate projects was typically outside the consultant's brief and on-site staff had limited time and inclination to conduct the evaluation, despite attempts by the corporate energy practitioner to allocate responsibility for the evaluation of particular projects (see Box 10 in Figure 7.4). This situation was described by a Principal Energy Advisor in the mining sector as follows:

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[30] Presenter BT Sustainability Manager Commercial 2012; Presenter CH Manager Environment & Sustainability Mining 2012

[31] Interviewee CS Carbon and Energy Manager Mining 2013

> "We got people from the site involved in the room for a workshop but the consultants were very much controlling it. A lot of the ideas came directly from the consultants. They would say 'we are here to do an audit and identify all these opportunities and what do you think of this opportunity or that opportunity'. We tried to allocate projects for people to follow up but it just went nowhere."[32]

This finding is significant because it reflects the level of understanding about staff engagement that was widespread across respondents when they first began to conduct energy efficiency assessments under the legislation. That is, they considered that getting personnel together for a workshop would sufficiently engage and involve staff in the process. However, they found that staff engagement required other strategies as well in order to be successful.

This limitation was particularly prevalent in cases where there was limited site management support and personnel had legitimate constraints on the time they could contribute towards the energy efficiency assessment. In cases where the energy efficiency assessment had been commissioned by the engineering or environment department, then the onus would often be put back on those who had commissioned the audit to complete it – particularly in the case where the expectations were that the consultant would 'do the audit', including an evaluation of all of the ideas identified.[33]

A third limitation that was evident, even in less complex sites (e.g. commercial buildings), was that there was a lack of energy data in a form that could support analysis of the potential costs and benefits of energy efficiency projects (see Box 11 in Figure 7.4). The limited availability of appropriate energy data at the commencement of an assessment is highlighted in the following quote from a GM Carbon and Energy in the mining sector:

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[32] Interviewee CQ Principal Energy Advisor Mining 2013

[33] Presenter BP Group Sustainability Manager Manufacturing 2012; Presenter BV Manager Resource Efficiency & Climate Change Manufacturing 2012; Presenter CE Energy Manager Mining 2012

> "What was hard was for an organisation like ours where this had never been looked at before is that you got a bunch of engineers out on site, engineers love data, it's all out there but it was everywhere. Data was ... it was fragmented, there were no real processes for it, there were gaps, there were errors, there was duplication…it was, frankly a mess."[34]

Faced with limited time and resources to conduct the assessment, consultants would typically only be able to do a limited amount of work in gathering the data. The task would be passed on to the company in the form of a list of the information and data that the consultant required to conduct their analysis. The consultant would complete the energy efficiency assessment based on whatever data the organisation was able to provide, which was often less than that required by the EEO legislation. Working to a limited scope, consultants would use whatever data they could access. Combined with the lack of knowledge about core energy-using processes, lack of availability of internal staff with knowledge of these processes and energy data, consultants would typically focus on the opportunities that they found to be easiest to evaluate.[35]

The combined impact of the three common limitations (i.e. the consultants' limited knowledge of core business processes (see Box 4 in Figure 7.4), lack of involvement of site personnel in the energy efficiency assessment process (see Box 9 in Figure 7.4) and limited access to energy data (see Box 11 in Figure 7.4)) was that the potential benefits associated with energy efficiency improvement projects were often not fully realised. The interrelationships between these issues is depicted in Figure 7.4. This figure illustrates how such limitations led to poor quality business case proposals which, in turn, made it difficult to access funding for projects. This appeared to have contributed towards fewer projects being implemented and therefore fewer benefits being obtained (see Box 12 in Figure 7.4). Without significant benefits, there would be little reason for senior management to require or encourage greater involvement of site personnel in energy management.

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[34] Presenter AA GM Carbon & Energy Mining 2011

[35] Presenter AE Energy Engineer Manufacturing 2011; Presenter AI Maintenance Superintendent Transport 2011; Presenter AN Director Consultancy Commercial 2011; Presenter BE Product Manager Mining 2011

Although the EEO legislation provided an important catalyst for change, initial interpretations of the requirements and the tendency for organisations to apply traditional energy management practices limited the effectiveness of the legislation to encourage more effective energy management practices to be developed and applied. This situation is explained by a Carbon and Energy Manager in the manufacturing sector:

> "Five years ago when EEO was new, everyone was trying to understand what it was all about. There were consultants who said they could tell you what it meant and what you had to do but in retrospect they didn't really understand. And there were all sorts of people who thought it involved a lot more complexity than it did. It took us all quite a while to work it out."[36]

In particular, corporate energy practitioners with a background in energy and environmental auditing found it particularly challenging to determine the most appropriate approach to meet legislative requirements associated with demonstrating that the right people were involved in energy efficiency assessments and that senior managers supported energy efficiency improvement.[37] Underlying attitudes and beliefs within organisations and across industry sectors that energy management was mainly about energy cost saving and should be approached in a way that limits the involvement of internal personnel made it difficult for corporate energy practitioners to meet the requirements of the legislation.[38] Further, as Figure 7.4 highlights, the main interaction between corporate energy practitioners and external stakeholders was with the Department of Industry (responsible for the EEO legislation). However, soon after the EEO legislation commenced, growing interest on the part of other government departments, customers and investors provided an opportunity for corporate energy practitioners to challenge the traditional beliefs and practices associated with energy management and to develop practices that would go some

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[36] Interviewee CS Carbon and Energy Manager Mining 2013

[37] Presenter AC Energy Analyst Manufacturing 2011; Presenter AQ Sustainability Manager Commercial 2011; Presenter BC Superintendent Energy Mining 2011; Presenter BH Energy & Carbon Manager Commercial 2012

[38] Interviewee CM Climate Change & Resource Efficiency Manager Multi Sector 2013; Presenter BH Energy & Carbon Manager Commercial 2012

way towards addressing the limitations described in this section of the case study.

7.4 The influence of emerging stakeholders on energy management practices

> *"Energy efficiency has become synonymous with quality and value. It has become much more than simply the value of the energy savings."*
>
> *Sustainability Manager, commercial sector*[39]

Respondents explained that energy management had traditionally been promoted as a mechanism to reduce energy costs.[40] In the decade leading up to 2006, deregulation of previously state-run electricity and gas monopolies contributed to falling electricity and gas prices as newly-established energy retailers sought to build market share. Falling prices and competition in the market meant that it was easier to reduce energy costs throughout this period through the negotiation of energy supply contracts, rather than attempting to influence the way in which energy was actually used in an organisation. Since energy costs were able to be reduced significantly through contract negotiations over the period leading up to 2006, there was little pressure from management in most organisations to improve energy efficiency performance through capital investments or operational changes.[41]

Other factors that contributed to a relatively low level of attention to energy management in the period leading up to the introduction of the EEO legislation include the presence of a widely-held perspective that energy efficiency would deliver relatively small financial benefits. This was particularly the case in organisations where energy costs were a relatively small proportion of total overhead costs.[42] In addition, since energy efficiency requires changes to be made to

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[39] Interviewee CK Sustainability Manager Commercial 2013

[40] Presenter AD Principal Greenhouse & Energy Manufacturing 2011; Presenter BN Carbon Policy Manager Manufacturing 2012; Presenter BS Climate Change Manager Multi-sector 2012

[41] Interviewee CK Sustainability Manager Commercial 2013; Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

[42] Interviewee CL Principal Climate Change and Energy Efficiency Mining 2013; Presenter BQ Senior Environmental Specialist Transport 2012; Presenter BZ Environmental Systems Manager

equipment and processes, it was considered relatively difficult to achieve and it was thought that any changes would also risk disrupting core operating processes. This situation was captured by the Superintendent for Energy in a mining sector organisation who used the term: "if it ain't broke then don't fix it"[43] – implying that the risk of creating more problems by changing technologies or operational practices typically outweighed the perceived benefits of saving energy. The Project Manager for Energy Efficiency in a manufacturing organisation suggested that the culture of engineers in his organisation had also contributed to the lack of interest in energy efficiency. In his view: "engineers in our organisation are more interested in building things rather than saving things like energy."[44]

At the time when the EEO legislation commenced, there were few other influences or drivers from stakeholders in the organisational field. However, soon after the introduction of the EEO legislation, actions from influential organisational stakeholders (including government, investors and customers) contributed to and reinforced a changing perception of the value of energy management. This section of the case study examines the emergence of these new business drivers as stakeholders became progressively more interested in the energy efficiency performance of large energy consuming organisations. It also highlights the ways in which corporate energy practitioners both influenced the actions of these new stakeholders and used their influence to build support for energy management within their own organisations.

Manufacturing 2012

[43] Presenter BC Superintendent Energy Mining 2011

[44] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

7.4.1 Increasing government influence on energy management

> *"When we started our energy efficiency program the energy costs weren't as important as the fact that there was a mandatory requirement. Our actions were driven by the legislation first and then reinforced as electricity costs began to rise."*
>
> *Project Manager Energy, manufacturing sector*[45]

Corporate energy practitioners explained that the introduction of the EEO legislation in 2006 had (for the first time in most organisations) made energy management a business risk associated with legislative compliance, rather than just a cost-saving initiative. Legislative compliance as a business driver for energy management was further reinforced by the introduction of the NGER Act. The new NGER legislation required companies to report their energy use and greenhouse gas emissions annually to the federal government. Since the EEO and NGER legislation involved public reporting of energy data and other information, these legislative drivers also created a potential reputational risk for companies. The purpose of the NGER Act was to underpin the development of a future emissions trading scheme by requiring parties who would potentially have an obligation under a scheme to provide accurate and reliable energy and greenhouse gas data at the level of each site and across the corporation as a whole. At the time of its introduction in July 2007, both major political parties in Australia had policies suggesting that some form of carbon pricing would be introduced, although the design and coverage of such schemes had not yet been developed.

Presenters and interview respondents described a number of government-related key events (see Figure 7.5 for a list of these key events) that occurred over the study period and which influenced their organisational response to energy efficiency. Figure 7.5 is followed by a description of each event and the influence that it had on the energy management practices adopted by organisations.

The top line of Figure 7.5 highlights the timing of the introduction of the EEO and

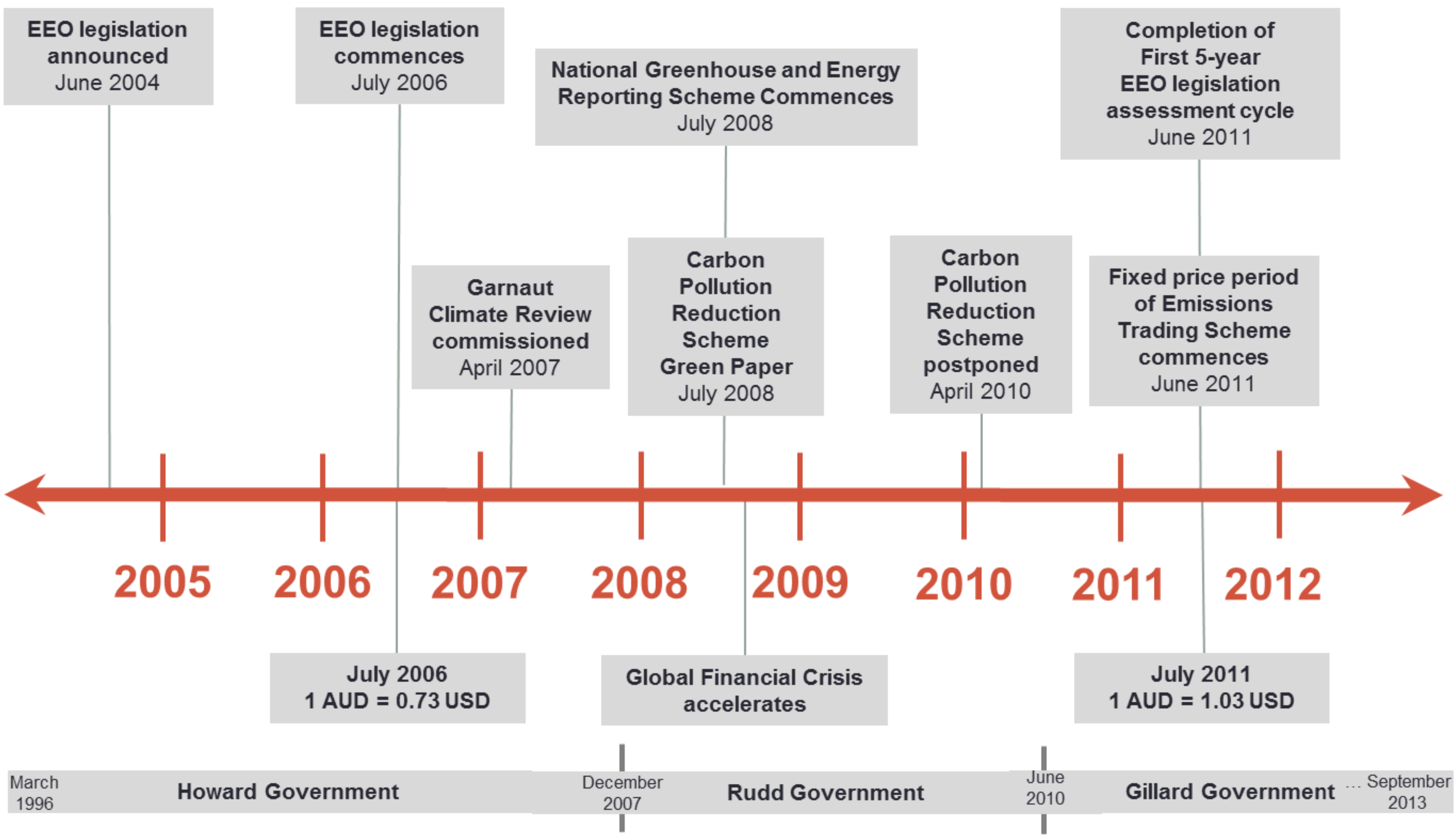
[45] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

NGER legislation. The next line highlights key events associated with the introduction of a national carbon pricing scheme. Boxes on the next line in Figure 7.5 provide wider economic context – specifically, the changing value of the Australian dollar. The bottom line outlines the different national government's over the period.

In April 2007, the federal Labor Party (when in opposition) in conjunction with Australian state and territory governments commissioned the Garnaut Climate Change Review (Garnaut 2008). The aim of this review was to examine the impacts of climate change on the Australian economy and recommend appropriate policy frameworks to address them, including carbon pricing. In the same year, and in response to growing community interest in the issue of climate change and reducing greenhouse gas emissions, the Howard Government announced a plan to introduce an emissions trading scheme (ETS) by 2011.

In December 2007, the incumbent government lost the election and the new Labor Government , led by Kevin Rudd, was elected. One of the first acts of the new government was to ratify the Kyoto Protocol at the Bali United Nations Framework Convention on Climate Change (UNFCCC) in December 2007. This was a highly symbolic gesture since it contrasted with the previous government's policy not to ratify. At this time, survey research suggested that public awareness of climate change was very high with a majority of Australians agreeing that Australia should take action to reduce greenhouse gas emissions (Leviston & Walker 2011). The initial proposal for an ETS (called The Carbon Pollution Reduction Scheme (CPRS)) failed to pass through the Senate in Parliament. This was because the government needed the support from the Greens Party and/or the opposition party and such support was not forthcoming. In the meantime, the tumultuous and uncertain character of the debate about introducing an ETS continued.

Figure 7.5: Timeline of key events in the organisational field that influenced energy management practices



A leadership spill resulted in Prime Minister Rudd being replaced by Julia Gillard. An election was later held in June 2010, the result of which was a hung parliament. The Gillard Government secured the support of the Australian Greens and three independents in order to form government. Part of this negotiation included an agreement to establish an ETS. Legislation to introduce an ETS with a three-year fixed-price period passed parliament in 2011. This scheme commenced operation on 1 July 2012.

Other policies that would impact on large energy consumers included the Renewable Energy Target Scheme legislation (Renewable Energy (Electricity) Act 2000 (Cth)) , which had been established in 2000 as a market-based policy mechanism designed to create demand for renewable energy. In 2009, the target was expanded by nearly five times to meet the government's policy commitment that at least 20% of Australia's electricity would be sourced from renewable energy by 2020 (Climate Change Authority 2012). The Renewable Energy Target Scheme legislation had already impacted on electricity prices and the increase in the target meant that electricity prices would be expected to rise further.

According to respondents, the changing political environment contributed towards a broadening of their role as corporate energy practitioners. Many began to play a role in reviewing energy and climate change-related government discussion papers, reports and draft legislation on behalf of their organisations. Corporate energy practitioners typically provided internal briefings to management and coordinated submissions to government outlining the impact of proposed energy and climate change-related legislation and its potential impact on their organisations. Practitioners were often involved in public fora which were designed to offer organisations an opportunity to provide input into draft legislation.[46]

[46] Presenter AF Group Environment Manager Mining 2011; Presenter AM Head of Sustainability Commercial 2011; Presenter BI Greenhouse & Energy Advisor Mining 2012; Presenter BT Sustainability Manager Commercial 2012; Presenter BW Environmental Advisor Commercial 2012; Presenter CD Environmental Sustainability Manager Commercial 2012

The government also played a role in supporting capacity building and skills development. For example, the Department of RET developed a National Training Strategy for the Development of Energy Efficiency Assessment Skills (Lund et al. 2010). It has also developed case studies and guidance materials and has hosted annual conferences with the aim of sharing information that organisations can use to meet their obligations and maximise the business benefits from energy efficiency. Direct funding and loan schemes have also been developed to support organisations that have identified projects, but do not have the funds to implement them. This includes a range of programs covering grants, loan financing, tax incentives and mandatory obligation schemes (e.g. the New South Wales Energy Savings Scheme) which required electricity providers to purchase energy savings certificates.[47] In 2012, the Clean Energy Finance Corporation was established with AUD10b to:

> "… overcome market barriers that hinder the financing, commercialization and deployment of renewable energy, energy efficiency and low emissions technologies".[48]

Through their interactions with government and other organisations, corporate energy practitioners and the organisations that they represented were influential in shaping the design of government legislation through a recursive process.[49] This process was articulated by the Carbon Policy Manager from an energy generation sector[50] organisation in the following way:

> "There was a little bit of resistance in the generation sector to the introduction of the EEO legislation. So we did quite a lot of work together with the department. The department then decided to set up some trial assessments in order to get some further information as to how the EEO legislation could actually be applied to the sector. We have also set up an energy efficiency working group … and I think we finally have

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[47] http://www.ess.nsw.gov.au/Home accessed September 2013

[48] http://www.cleanenergyfinancecorp.com.au/energy-efficiency.aspx accessed September 2003

[49] Presenter AU Infrastructure Capability Manager Manufacturing 2011;

Presenter AT Sustainability Analyst Manufacturing 2011;

Presenter BM Greenhouse & Energy Advisor Manufacturing 2012;

Presenter BT Sustainability Manager Commercial 2012

[50] The EEO legislation was extended to electricity generation organisations from 1 July 2011

got a really good approach, a very practical approach to be compliant with the EEO legislation and yet to achieve good outcomes for our organisations."[51]

Table 7.3 briefly summarises the key legislation introduced over this period and highlights the different business risks associated with each piece of legislation from the perspective of respondents. A risk management perspective is included here because some government legislation had a direct impact on the organisations with obligations under the EEO legislation. Legislation also influenced the expectations of key organisational stakeholders, such as investors and customers. Therefore, the combination of legislation and expectations presented more than just a risk of non-compliance; it also presented potential reputation and market risks for organisations. These issues relating to the legislation were used by corporate energy practitioners to frame the growing importance of energy efficiency within their organisations,[52] which, in turn, supported the development of new energy management practices (as described in Chapter 8).

Table 7.3: Key legislation introduced between the years 2006–2012

Legislation	Requirements	Risk management perspective
Energy Efficiency Opportunities Act 2006 (Cth)	• Large energy consumers are required to conduct energy efficiency assessments and provide annual public reports on the outcomes of these assessments • In 2006, 199 corporations registered • By May 2012 there were a total of 319 corporations registered (RET 2012a)	• Legislative compliance risk • Reputational risk

[51] Presenter BN Carbon Policy Manager Manufacturing 2012

[52] Interviewee CN Business Development Manager Transport 2013; Presenter AA GM Carbon & Energy Mining 2011; Presenter BB Energy Champion Manufacturing 2011; Presenter BN Carbon Policy Manager Manufacturing 2012; Presenter BU GM Sustainability Commercial 2012; Presenter CE Energy Manager Mining 2012

Legislation	**Requirements**	**Risk management perspective**
National Greenhouse and Energy Reporting Act 2007 (Cth)	Report annually for site and corporation: • total energy consumption • scope 1 greenhouse gas emissions • scope 2 greenhouse gas emissions Information at corporation level reported publicly on government website. In 2011/12 reporting year, 833 Registered Corporations	• Legislative compliance risk • Reputational risk
Renewable Energy (Electricity) Act 2000 (Cth) extended in 2009	Extension of the target expected to increase electricity prices	• Financial risk (due to rising electricity costs)
Building Energy Efficiency Disclosure Act 2010 (Cth)	An up-to-date Building Energy Efficiency Certificate (BEEC) needs to be disclosed to prospective buyers and tenants (in most cases) when office space of 2,000 square metres or more is offered for sale, lease or sublease.	• Legislative compliance risk • Market risk
Clean Energy Act 2011 (Cth)	A price on carbon including a fixed price period for three years starting at AUD23/tonne in July 2011 before reverting to a price established by the market	• Compliance risk • Financial risk (rising energy costs and costs associated with direct liability for self-generation)

7.4.2 Growing investor interest in climate change and energy efficiency

> *"In around 2010 at one of the regular briefings with our investors our CEO was asked about what the average NABERS Energy rating of our portfolio was and where was it going to go. I think the interest from investors is not so much that an efficient building means additional value – but that an inefficient building raises alarm bells in terms of the investment required to get it up to scratch."*
>
> *Manager Sustainable Building Operations, commercial building sector*[53]

Development and, ultimately, the introduction of a carbon price in Australia was a contributing factor in the increasing interest and awareness of investors about how companies were addressing the risks associated with associated with energy use and greenhouse gas emissions. Respondents explained that over the study period their organisations were increasingly being asked to complete investor questionnaires that requested information about the organisation's energy and greenhouse gas performance.[54] Questions were incorporated into sustainability-related financial indices such as the Dow Jones Sustainability Index (DJSI) and FTSE4Good Index for example. Organisations also faced mandatory reporting under the EEO legislation. Around one quarter of the respondents were responding to surveys and reporting under the Carbon Disclosure Project (CDP) as well as through their own public sustainability reports.[55] The CDP is a non-profit organisation backed in 2013 by more than 722 institutional investors representing more than USD87trillion in assets (CDP 2013).

Government reporting programs that sought increasing transparency of energy and greenhouse performance were improving the accessibility of information to investors. For example, in the property sector a star rating system for the operational

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[53] Interviewee CK Sustainability Manager Commercial 2013

[54] Case DH GPT Group Commercial Sector 2012; Presenter BC Superintendent Energy Mining 2011; Presenter BD Energy Coordinator Mining 2011; Presenter BI Greenhouse & Energy Advisor Mining 2012; Presenter BM Greenhouse & Energy Advisor Manufacturing 2012

[55] Case CX Thiess Mining Mining Sector 2010; Presenter AF Group Environment Manager Mining 2011; Presenter AT Sustainability Analyst Manufacturing 2011; Presenter BE Product Manager Mining 2011

energy performance of buildings had first been introduced as a voluntary scheme in the early 2000s. In 2010, NABERS became mandatory for larger commercial properties when the *Building Energy Efficiency Disclosure Act 2010 (Cth)* was introduced.

Investors now have access to information that they can use to assess the energy performance of buildings which can also provide a proxy indication of issues, such as building obsolescence, since energy efficiency performance is increasingly linked to building quality.[56] In this way, energy efficiency has become of growing relevance to investors. The first annual aggregated report by the regulator of NABERS showed that, by July 2013, three quarters of Australia's commercial office buildings had received NABERS ratings (NSW OEH 2013).

Investor interest has been particularly strong in the commercial sector. However, in the mining and other sectors, companies face risks associated with cost containment as electricity prices increase due to spending on energy infrastructure, as well as the impact of legislation (e.g. legislation relating to the carbon price).[57] Mining is one of the sectors that will be most impacted by a carbon price. It is also the sector with rapidly-growing energy intensity as mines are deeper and the quality of ore decreases, meaning that more transport and greater processing are required – both of which are energy intensive.[58]

Growing interest by investors also meant that practitioners were able to use the interest by investors in climate change and energy efficiency by increasing disclosure of their performance beyond compliance requirements.[59] For example, one practitioner found that greater transparency of a building's energy performance

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[56] Case DJ National Australia Bank Commercial Sector 2012; Interviewee CK Sustainability Manager Commercial 2013; Presenter BT Sustainability Manager Commercial 2012

[57] Interviewee CQ Principal Energy Advisor Mining 2013; Presenter AA GM Carbon & Energy Mining 2011

[58] Presenter AG Manager Energy & Emissions Projects Mining 2011; Presenter BF Senior Consultant Mining 2011; Presenter CJ Senior Consultant Mining 2012

[59] Presenter AK Manager Climate Change & Environment Commercial 2011; Presenter AQ Sustainability Manager Commercial 2011; Presenter AS Chief Financial Officer Commercial 2011

to external stakeholders could motivate the decision-makers in his own organisation more than he would be able to do by communicating the issues directly to those decision-makers himself. The General Manager for Sustainability in the commercial sector explained that:

> "Disclosure [of the energy performance of our buildings] has motivated the fund managers and the people at the investment level in the group who were very unhappy about the idea that [our premium grade office building] might be losing some of its edge – as indicated by its poor energy performance. This is one of our flagship buildings so it is really important that the building has a good reputation. The capital works are underway now, the business cases have got through the system and we're spending several million dollars just on the building automation system."[60]

In this case, the practitioner had been active in encouraging his organisation to go beyond the disclosure required by legislation about energy efficiency and the overall sustainability performance of their buildings. As this quote highlights, the strategy of encouraging external disclosures helped to encourage internal stakeholders to improve the energy efficiency performance of the building.

This provides an example of a corporate energy practitioner using a strategy that involves actively engaging *external* stakeholders in order to influence the organisation's *internal* stakeholders whose support the corporate energy practitioner requires to further the organisation's energy efficiency improvement program. Table 7.4 summarises the key mechanisms encouraging interactions between investors and large energy consuming organisations on energy efficiency (discussed above).

[60] Presenter BU GM Sustainability Commercial 2012

Table 7.4: Interactions between investors and organisations on energy efficiency

Mechanism	Actions
Investors briefings	Investors request information from organisations about how they are managing risk associated with energy use. [61]
Organisational public reporting	Organisations provide information to stakeholders about their environment and/or sustainability performance on a voluntary basis. This may include energy efficiency information. EEO reports are provided to the public in order to meet the obligations under the EEO legislation.[62]
Government reporting	NGER Scheme data is aggregated by the government and made available publicly, as required under the legislation.[63]
Investor indices	E.g. DJSI and FTSE4Good. Organisations participate in these measures to build their reputation and to attract and maintain investors.[64]
Investor surveys and reports	E.g. CDP. Organisations complete surveys highlighting climate change-related risks and the actions they are taking to manage them.[65]

[61] Interviewee CK Sustainability Manager Commercial 2013; Presenter AQ Sustainability Manager Commercial 2011

[62] Case DM Foster's Group Manufacturing Sector 2012; Presenter AT Sustainability Analyst Manufacturing 2011

[63] Presenter AA GM Carbon & Energy Mining 2011; Presenter BV Manager Resource Efficiency & Climate Change Manufacturing 2012

[64] Presenter BT Sustainability Manager Commercial 2012

[65] Case CX Thiess Mining Mining Sector 2010; Case DH GPT Group Commercial Sector 2012; Presenter AF Group Environment Manager Mining 2011; Presenter AT Sustainability Analyst Manufacturing 2011; Presenter BE Product Manager Mining 2011

7.4.3 Rising customer demand for energy efficiency

> *"We proactively educate our clients. We go to them and acknowledge that they are an exposed industry with the carbon price coming in and energy costs going up. We then explain that we have done a lot of projects that involve minimizing carbon and energy use. This approach gives us an extra "feather in our cap" when we are tendering for projects."*
>
> *(Manager Greenhouse & Sustainability, Mining in the mining sector)*[66]

Growing awareness across the Australian economy regarding the drivers for and benefits associated with effective energy management, presented an opportunity for some organisations to promote their energy management programs, enhance their reputation, differentiate themselves from competitors, and even develop new product and service offerings for their customers.

Corporate energy practitioners described a diverse range of ways in which their organisations were using energy management to position their organisations in the marketplace. For example, a large contracting organisation that provides mine operation and construction services had developed a set of energy measurement and management tools, which allowed them to track and report energy used in mining trucks on a shift-by-shift basis. This organisation actively promotes their use of these tools to their existing and potential clients as a way of demonstrating their commitment to innovation, reducing costs and managing environmental impact. This helps to increase their competitiveness when bidding for new customers – even if these potential clients do not explicitly request energy management services.[67]

The Environmental Sustainability Manager in a firm in the commercial sector explained that his organisation found that by demonstrating tangible outcomes from energy management programs they managed with their existing customers, they were able to give other clients greater confidence in their ability to deliver the same

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[66] Presenter AH Manager Greenhouse & Sustainability Mining 2011

[67] Presenter AH Manager Greenhouse & Sustainability Mining 2011

outcomes in their buildings.[68]

As well as being proactive in promoting their organisations' energy management approach, corporate energy practitioners report that they have seen an increasing number of requirements for information about the energy management-related services they can provide.[69] A Business Development Manager in the transport sector explained that, within the past 18 months, he had seen tenders that explicitly requested information from contractors about the systems and processes they would use to measure and report on energy use and greenhouse gas emissions. Another tender had requested information about how energy efficiency would be optimised and what options could be provided to offset any remaining greenhouse gas emissions.[70] In this way, the customers themselves were actively influencing the market of service providers.

The Head of Sustainability within a financial services firm had built support for energy management within the organisation by presenting energy management as an opportunity for the organisation to learn about the benefits and difficulties associated with providing lending products for energy efficiency projects. By developing that experience and knowledge within the organisation, it was expected that it would provide insights and reduce the risk associated with developing new lending products to meet the growing demand for financing energy efficiency projects. In this way, energy management was viewed as a low-risk approach to developing and marketing new products at the same time as it reduced the firms operating costs and developed their corporate reputation.[71]

Organisations have also developed collaborative relationships with customers to create new and innovative approaches to energy management. For example, a transport organisation worked closely with a customer and an equipment supplier to

[68] Case DI Spotless Commercial Sector 2012

[69] Interviewee CN Business Development Manager Transport 2013; Presenter CD Environmental Sustainability Manager Commercial 2012

[70] Case DT Ron Finemore Transport Sector 2012

[71] Presenter AM Head of Sustainability Commercial 2011

design a larger trailer to transport grain. This improved the amount of fuel required to transport each tonne of grain and created a range of other benefits, such as reducing truck movements on public roads, increasing productivity and reducing maintenance and other costs.[72]

In the commercial building sector, a tenant in an office building worked collaboratively with the building owner to retrofit the building in order to deliver significant energy savings as well as other financial and environmental benefits. Typically, there is a misaligned incentive between the owner and the tenant in a building, since the owner pays for the upgrade and the tenant receives the benefits in reduced energy costs. However, in this particular case, the owner and the tenant negotiated an arrangement that achieved a positive outcome for both parties. The project highlighted that – through negotiation – the owner and the tenant were able to identify shared benefits from a building upgrade. As a result of this process, the productivity of the office space has been increased, even as operational energy use and environmental impact has been reduced.[73]

In summary, corporate energy practitioners described three different ways in which their organisations are using their energy management programs as a commercial opportunity:

1. active marketing
2. tenders, and
3. product development (see Table 7.5).

[72] Case DT Ron Finemore Transport Sector 2012

[73] Case DJ National Australia Bank Commercial Sector 2012

Table 7.5: Interactions between organisations and their customers

Approaches	Actions
Active marketing	Energy management can enhance the organisation's reputation, differentiate it from competitors and demonstrate commitment and ability with regard to innovation.
Competitive tendering	Increasingly tenders require service organisations to describe their approach to and tools for energy management. This may be needed to meet the core requirements of a tender or may be requested as an optional 'value add'.
Product development	Organisations are increasingly using their internal energy management programs as a means to develop new products and services, which they subsequently offer to their customers. These may be developed through collaboration with customers and other stakeholders, such as equipment suppliers.

7.4.4 The implications of changing activity in the organisational field

At the same time as organisations were involved in conducting energy efficiency assessments as part of the first five-year cycle of the EEO legislation, the organisational field associated with energy management was experiencing a period of dynamic change. New stakeholders were entering the field and the level of interest and influence of existing stakeholders was expanding. The changing interests and influence of key stakeholders (including government, investors and customers) had the effect of raising the profile of energy management within and external to organisations as well as influencing perspectives of the benefits that effective energy management could deliver to organisations. From an activity that had previously been defined as primarily an energy cost-savings initiative, the emergence of new stakeholders broadened the perceived value of energy efficiency to include managing compliance risk, enhancing reputation, attracting and retaining new customers and even towards supporting business growth through the development of new products and services.

Changes in the organisational field did not occur in isolation from the influence of large energy consuming organisations. Through the work of corporate energy practitioners and other staff, they attempted to influence the perspective of external stakeholders in a number of ways. Government policy and legislation could be influenced through formal consultation mechanisms that were established around the release of consultation papers and draft legislation. Organisations also worked through industry associations to present their particular interests. Corporate energy practitioners were also active in promoting their achievements through government-sponsored conferences and written case studies. By adopting a leadership role and promoting their achievements, corporate energy practitioners helped shape the wider industry perspectives on the appropriate practices associated with energy management, even as they were in the process of creating legitimacy for such practices within their own organisations.

Investor and customer interest in energy management has been influenced by the increasing volume of government legislation – particularly the introduction of a price on carbon, as well as rising energy prices. Investors seek information from organisations through surveys and briefings. Responding to investor surveys and briefing investors provided organisations with an opportunity to highlight their own performance, which in turn could put pressure on their competitors to do the same. Corporate energy practitioners have also influenced customers by actively promoting their energy management approach (including specific products and services) by responding to tenders and developing new products – often in collaboration with customers and other stakeholders (e.g. equipment suppliers). Rather than operating in isolation from one another, these changes can be seen to have reinforced one another. This process can be characterised as one in of self-reinforcement – creating growing legitimacy for energy management as a means of addressing business risk and obtaining benefits.

7.5 Summary

This chapter has:

- provided background information on energy use in Australia and the considerations that informed development and commencement of the EEO legislation in 2006
- explained the traditional and established (i.e. institutionalised) energy management practices applied by large energy consuming organisations as they first began to respond to their obligations under the EEO legislation, and
- presented an analysis of the emerging interests and influence of three key stakeholder groups:
    1. government
    2. investors, and
    3. customers over the study period (2006–2012).

In Chapter 8, these findings will be further expanded through analysis of four key energy management practices areas in which significant changes were observed over the study period.

8. The evolution of energy management practices

8.1 Introduction

As Chapter 7 revealed, the typical response by organisations in the first assessments that were conducted to meet obligations under the EEO legislation reflected a set of energy management practices based on assumptions about the resourcing, frequency and value of energy efficiency. That is, energy management was treated as an episodic process, external consultants were considered to be the credible and legitimate means of conducting assessments, and the value of energy efficiency improvement was primarily associated with energy cost savings. However, over the period 2006–2012 there were substantial changes in the organisational field associated with energy management practices. In particular, increasing government legislation and the growing concerns and interests of investors and customers influenced the evolution of energy management practices.

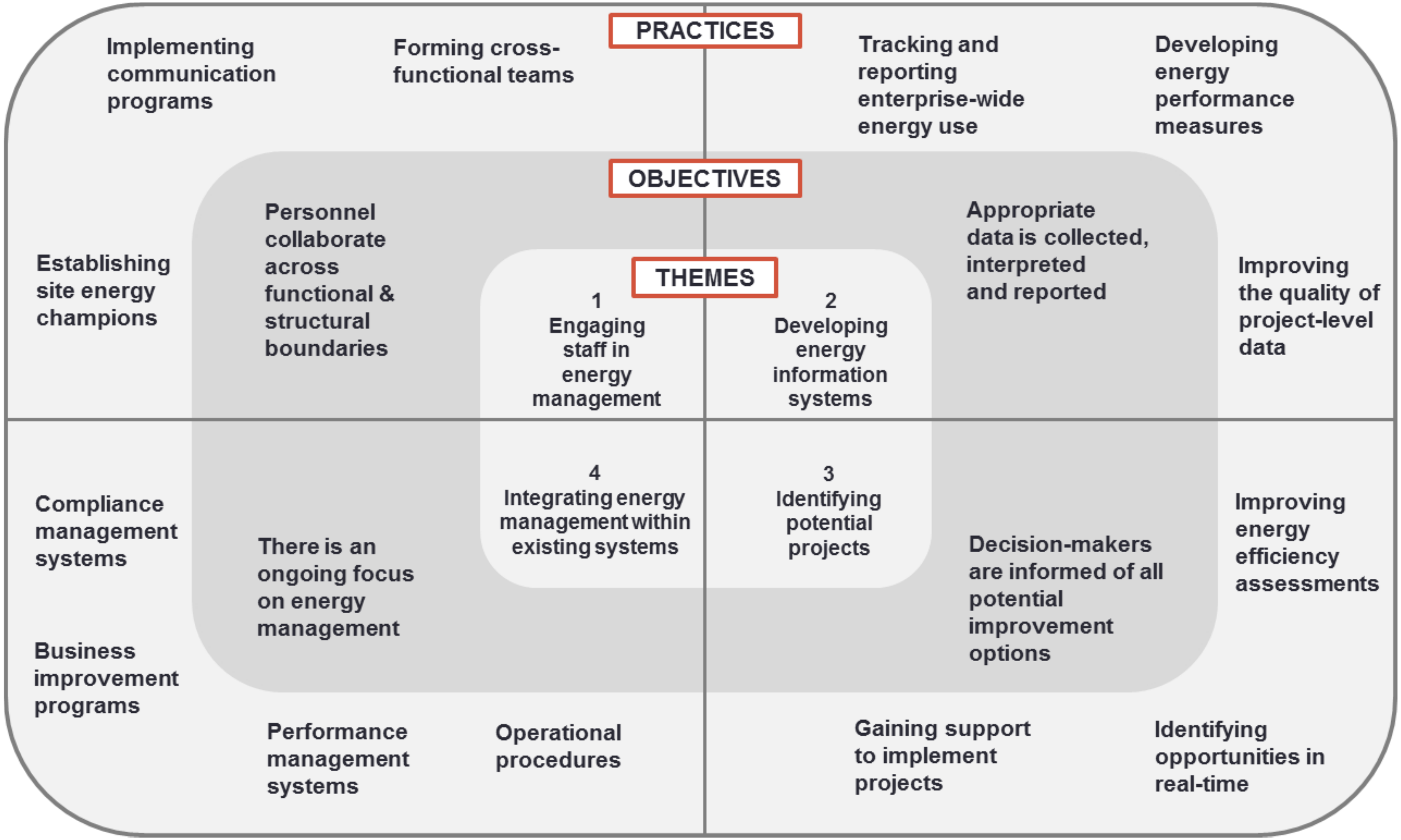
In the present chapter, the changes to energy management practices described by corporate energy practitioners in public conference presentations, interviews and case studies developed by the Department of RET are presented. Chapter 8 is structured in accordance with four key themes that have emerged from the research. These are:

1. engaging staff in energy management
2. developing energy information systems
3. identifying potential projects, and
4. integrating energy management into existing management systems.

While the themes, objectives and practices that emerged from the analysis are consistent with the energy management and organisational change literature, the practices contrast with those applied by organisations as they initially responded to the EEO legislation. Chapter 8 aims to expose the interactions between internal and external stakeholders and the social dynamics that support the successful implementation of such practices within an energy management context.

Figure 8.1 provides an overview of the research findings in respect of changing energy management practices. Key themes from the analysis are shown in the centre of the figure. In the dark shaded section, the objectives of each practice area are stated. In the outer section of Figure 8.1, the more specific energy management practices, for which significant change has occurred, are listed.

Figure 8.1: Themes, objectives and practices examined in this chapter



8.2 Theme 1 – Engaging staff in energy management

As organisations began to conduct energy efficiency assessments to meet the requirements of the EEO legislation, the limitations of a traditional 'energy audit' approach to energy management were being revealed to corporate energy practitioners. In particular, there was an expectation that external energy consultants would develop sufficient knowledge of their site in a short amount of time through which they would identify all available energy efficiency improvement projects. However, site specific knowledge – particularly associated with core production processes, was often held by local staff. Corporate energy practitioners explained that the limitations of this approach included the following:

- Fewer opportunities were typically identified than otherwise may have been with greater involvement of internal personnel.[74]
- The detailed information required to evaluate projects was lacking (particularly quantification of all business benefits, rather than just a focus on energy cost savings).[75]
- For those opportunities identified by consultants, there was a lack of motivation by internal personnel to be involved in progressing the evaluation and implementation of projects once the consultant left.[76]
- The poor quality of business case proposals and lack of organisational context suggested that fewer energy efficiency projects were ultimately implemented than otherwise might have been.[77]

This situation presented corporate energy practitioners with a challenge. On the one hand, there had been an expectation within their organisations that the use of energy consultants and a traditional energy audit approach was the most appropriate way to

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[74] Interviewee CQ Principal Energy Advisor Mining 2013; Presenter BW Environmental Advisor Commercial 2012

[75] Interviewee CO Environmental Manager Transport 2013; Presenter CB Technical Manager Manufacturing 2012

[76] Presenter AA GM Carbon & Energy Mining 2011; Presenter AV Project Manager Energy Efficiency Manufacturing 2011

[77] Presenter AP Energy & Sustainability Manager Commercial 2011; Presenter AL Energy Project Engineer Manufacturing 2011

conduct energy efficiency assessments – both in relation to achieving an effective outcome and as a means of reducing the time and effort required to meet compliance requirements. On the other hand, corporate energy practitioners found that in order to meet compliance requirements and to optimise business outcomes within their organisations, they required substantially greater involvement from internal staff.

The tension between these two positions is an important observation. It highlights the difficulty that practitioners face when obtaining resources and convincing management that a more comprehensive approach to energy management is required.

Even in cases where it was acknowledged that more internal personnel should be involved in energy management, the motivation and resources available to corporate energy practitioners was not always forthcoming. This point is illustrated in the following comment from the Manager Greenhouse and Sustainability in the mining sector:

> "Everyone is just so busy. No matter how much of a legal requirement the EEO legislation is – and how good a business case you have got – it is always a challenge to get people to buy into the process and get involved."[78]

Corporate energy practitioners developed a range of strategies to broaden the involvement of personnel. This section of the case study describes three of the key energy management practices that had changed over the study period. These practices were used by corporate energy practitioners to engage personnel across their organisation and included:

- forming cross functional energy management teams
- developing and implementing communication programs to promote the benefits of energy efficiency and the action that staff could take in order to contribute to energy efficiency improvement, and
- assigning responsibility for energy efficiency improvement at the site level.

[78] Presenter AH Manager Greenhouse & Sustainability Mining 2011

8.2.1 Forming cross functional teams

Rationale

A key strategy that corporate energy practitioners used to broaden the involvement of personnel from different functional areas within their organisations was to establish cross functional energy teams.[79] Cross functional energy teams helped to overcome what corporate energy practitioners described as ‘the challenge of working across organisational silos’. By this they meant that there tended to be a lack of communication and coordination across various professional and functional groups within their organisations.[80] This was a particular challenge for energy efficiency in that it was widely perceived to be the domain of managers with technical engineering expertise and/or external consultants who were viewed as ‘energy efficiency experts’.[81] In some cases, projects were constrained by misaligned incentives in which the budget required to implement a project would need to be drawn from one division of the business (e.g. maintenance), while the benefits would accrue to another department in the form of energy savings (e.g. operations).[82] Establishing cross functional teams helped to improve communication and collaboration across multiple internal groups.

The involvement of a range of personnel also had an impact at the project level since the relative importance and influence of various internal stakeholders would vary from one project to another. For example, frontline operators could often yield significant influence over decisions associated with energy efficiency initiatives that required changes to daily operational practices.[83] In contrast, large projects often required significant financial resources – in the form of accounting, finance and

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[79] Case DN Centennial Coal Mining Sector 2012; Presenter AH Manager Greenhouse & Sustainability Mining 2011

[80] Presenter BD Energy Coordinator Mining 2011; Presenter CI Principal Consultant Mining Mining 2012

[81] Interviewee CS Carbon and Energy Manager Mining 2013; Presenter BH Energy & Carbon Manager Commercial 2012

[82] Interviewee CQ Principal Energy Advisor Mining 2013; Presenter AD Principal Greenhouse & Energy Manufacturing 2011

[83] Case DK Sydney Water Utility Sector 2012; Presenter AI Maintenance Superintendent Transport 2011

senior management personnel – to be involved in such decisions.[84] Other groups that were mentioned by corporate energy practitioners as influencing energy efficiency performance are discussed in the following paragraphs.

Personnel involved in teams

The diversity of personnel who were involved, and the role of corporate-level steering committees, are illustrated by a Group Environment Manager in a mining company below:

> "To assist in the implementation of the policy, we've established a steering committee that consists of our Chief Operating Officer, General Manager of Sustainable Development, our Chief Financial Officer, our General Manager of Health Safety Environment and Community, and our General Manager of Business Support. And their role is to monitor policy development, develop standards … and to review internal and external funding applications. They are also expected to identify company-wide opportunities to assist us in preparing for a carbon constrained future."[85]

Table 8.1 lists a number of different roles within organisations and the contribution they can make to energy management. Table 8.1 has been drawn from conference presentations by corporate energy practitioners and the Energy Efficiency Opportunities Assessment Handbook (RET 2009, p. 19). The handbook was developed by the Department of Industry as a practical guide to support organisations with conducting energy efficiency assessments.

[84] Presenter AT Sustainability Analyst Manufacturing 2011

[85] Presenter AF Group Environment Manager Mining 2011

Table 8.1: Personnel involved in teams

Role	Contribution
Line managers	Focus energy management on improvements that are aligned with business priorities.
Engineering personnel	Identify project options and specify technical risks and requirements.
Business improvement personnel	Apply analytical skills and help to identify and capture the full business benefits of energy-saving projects (e.g. reducing bottlenecks which can lead to improved productivity).
Frontline operators	Identify and implement improvements in daily operational practices.
Production planners	Influence planning on production runs and other operational planning decisions which can effect energy use.
Accounting and finance personnel	Establish project financial costs and benefits and inform the rest of the team of the availability of, appropriate timing and access to internal funds.
Maintenance personnel	Identify opportunities and provide specific input to the maintenance implications of energy efficiency measures.
Procurement personnel	Establish the suitability of specifications, preferred supplier arrangements (if applicable) and standardised specifications.
Environmental managers	Highlight the environmental risks and opportunities associated with energy efficiency measures.
Work, health and safety personnel	Highlight the safety-related risks and opportunities associated with energy efficiency measures.
Human resources (HR) personnel	Support recruitment for energy-related roles. Incorporate energy responsibilities into existing roles. Provide input and advice regarding other initiatives (e.g. incorporating energy efficiency performance into performance management systems and training measures).

(Sources: RET 2009, p.19; Presenter BK Strategic Projects Manager in the mining sector 2012; Presenter BT Sustainability Manager in the commercial sector 2012; Presenter BH Energy and Carbon Manager in the commercial sector 2012; Presenter BC Superintendent Energy in the mining sector 2011)

While Table 8.1 highlights the most common roles, some organisations had other specialist staff involved. For example, the Project Manager Energy Efficiency in a manufacturing business involved a marketing manager who helped to promote the program across the business and with clients. The respondent's organisation also involved a supply chain development manager who was responsible for procurement, and whose role developed into one of helping to incorporate energy efficiency into the organisation's procurement processes. The organisation also involved an energy consultant in the energy team. One of the important benefits of having their long standing energy consultant involved was that it provided the consultant with a network of people within the organisation that the consultant could follow up with directly, rather than having to work through and involve the Project Manager Energy Efficiency himself.[86]

Teams as a symbol of legitimacy

Teams were used to achieve a range of different aims within organisations. Box 8.1 illustrates how an energy management team was used to regain momentum for energy efficiency in a mining organisation.

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[86] Presenter AV Project Manager Energy Efficiency Manufacturing 2011

Box 8.1: Establishing a corporate team to regain momentum for energy management

An organisation which owned and operated mines around Australia found that when the organisation first responded to the EEO legislation it had not established a strong corporate role for energy management. Rather, responsibility for fulfilling the obligations of the EEO legislation had been delegated directly to each site. As the organisation was preparing the first public report required under the EEO legislation within 18 months of program commencement, a number of potential issues of non-compliance were revealed. This occurred soon after the introduction of the NGER legislation and at a time when the federal government was undertaking consultations on the design of a carbon pricing scheme.

Faced with the risk of non-compliance and potential reputational issues, a decision was made by the corporate management team to establish a new role to manage energy and carbon issues. One of the first actions that the new energy management practitioner took was to establish a corporate-level carbon and energy team. The team included representatives from a diverse range of departments including:

- external affairs
- engineering
- research and development
- production, and
- environmental management.

The team also included mine managers from each site. One of the first actions of the team itself was to agree on accountabilities and reporting arrangements. The team also determined that site energy practitioners would be established at each mine.[87]

This example illustrates a number of the benefits associated with using a cross functional team. First, since this was a newly-established team, it provided a powerful symbol of the importance of energy management to the organisation. As the team was established following a period of poor performance, it also

[87] Presenter BK Strategic Projects Manager Mining 2012

demonstrated that such performance was considered by management to be unacceptable while acknowledging that additional resources were required to reduce the risk of poor performance in the future.

Second, by involving mine managers in the corporate team, these managers became directly accountable for the outcomes that were achieved on each of the sites. This enhanced the credibility of the corporate energy practitioner and facilitated collaboration between the corporate energy practitioner and the sites.

Third, the corporate energy team provided a central point of review. This was important, both in managing the expectation from the team that compliance obligations would be met, as well as ensuring that other business benefits were encouraged through the process. By involving the different functional areas, if there were any functional barriers limiting the uptake of projects, then the team provided a forum within which these barriers could be discussed and directly actioned through the team – potentially reducing significant delays in the program.[88] Ultimately, the team established a strong sense of legitimacy for energy efficiency within the organisation.

The example also highlights the influence of both the EEO legislation and pending introduction of a carbon price in motivating management to address underperformance and the reputational and business risks associated with non-compliance.

The use of different types of teams

Corporate energy teams were typically responsible for overall energy performance across an organisation. However, an alternative approach was to establish cross functional teams that were responsible for energy performance in a particular functional area or technology. This is illustrated in Box 8.2.

[88] Presenter BK Strategic Projects Manager Mining 2012

Box 8.2: Technology-based teams

An organisation in the transport and logistics sector established a number of high-level cross functional corporate teams. Each team had responsibility for improving energy efficiency in a particular technological area. Areas included:

- mobile equipment (e.g. trucks, trains etc.)
- logistics
- procurement, and
- other key operational areas in which energy efficiency improvement could be achieved.

Each team included a technology specialist as well as senior-level representatives from accounting and finance, operations and other functional areas. One advantage of this approach for the organisation was that it placed clear accountability for obtaining outcomes in each technology area. It also allowed technical specialists in particular areas to be involved in an efficient manner (since they could focus their efforts) and, over time, helped develop the technical knowledge and understanding of other personnel in a particular technology area (e.g. finance staff).[89]

Cross functional teams were also formed at the site level.[90] While the corporate-level teams put greater focus on management issues, at the site level, the cross functional teams were typically more focused on progressing the implementation of specific energy efficiency projects. Respondents suggested that the effectiveness of teams often varied from one site to the next. A Principal for Climate Change and Energy Efficiency in the mining sector described the importance of having the right people involved in the site-level team:

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[89] Interviewee CO Environmental Manager Transport 2013; Presenter CA Environmental Manager Transport 2012

[90] Presenter AD Principal Greenhouse & Energy Manufacturing 2011; Presenter AV Project Manager Energy Efficiency Manufacturing 2011; Presenter BD Energy Coordinator Mining 2011; Presenter CH Manager Environment & Sustainability Mining 2012

> "One of the big lessons learnt in our first five years was that it is essential to have the right people on the site driving the site energy teams. Having somebody that is the holder of the purse strings and understands the business driving the site energy team gets a lot more traction and buy in compared to those where the graduate engineer has the role of managing the team. We have seen the difference in the outcomes from the assessments."[91]

One of the advantages of having an established team at the site is that, by having personnel from different functional areas focused on energy management, the energy efficiency projects that are identified can be examined from a variety of perspectives.[92] Many energy efficiency projects have implications for operations, maintenance, HR (and potential people-related issues), environment and safety. Establishing a cross functional team at the site can reduce the likelihood of good projects being rejected and/or poor projects undergoing significant investigation by individuals only to be find that there is an operational or other reason that doesn't allow a seemingly promising project to be implemented.[93]

Responsibility and ownership was considered to be held by the team, rather than with a single corporate energy practitioner (another important advantage of establishing cross functional corporate teams).[94] Respondents viewed this as an important way of achieving a more enduring energy management program, and one where staff felt motivated to maintain new energy management practices on an ongoing basis. Site-based teams also helped to spread responsibility for progress on energy management beyond site-based energy champions or external energy

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[91] Interviewee CL Principal Climate Change and Energy Efficiency Mining 2013

[92] Case DR Australia Post Transport Sector 2012; Case DS Linfox Transport Sector 2012; Presenter BT Sustainability Manager Commercial 2012

[93] Interviewee CN Business Development Manager Transport 2013; Interviewee CQ Principal Energy Advisor Mining 2013

[94] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013; Presenter AU Infrastructure Capability Manager Manufacturing 2011

management consultants.[95] In reviewing performance against energy targets or scheduled energy management activities, for example, the responsibility for progressing such items was more likely to be considered a shared responsibility, rather than being the sole responsibility of the site or corporate energy practitioner.[96]

For the corporate energy practitioners, site-based teams could also provide a communication channel for sharing information about how the organisation as a whole had been performing and to share information about projects as well as other energy management initiatives that had occurred on other sites.

In some organisations transient teams would be formed to conduct formal energy efficiency assessments.[97] This would provide an opportunity to further involve personnel at the site in energy management. These teams would typically report back through to the site-level energy management team, which would, in turn, be responsible for reviewing the opportunities identified and providing support in progressing or evaluating such projects as required. Although less common, in some cases teams would be established specifically to undertake evaluation and/or implementation of a particular energy efficiency measure. This was typically required for large complex projects that presented a significant financial or operational risk or in cases where a high level of 'buy-in' was required (e.g. from operators and maintenance staff).[98]

8.2.2 Implementing communication programs

The majority of corporate energy practitioners explained that it was challenging to make energy visible and relevant to staff. Establishing site-level energy champions and cross functional teams played an important role in addressing this challenge. However, corporate energy practitioners had identified many other internal personnel who can influence energy use – often through their day-to-day activities. Examples

[95] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

[96] Interviewee CQ Principal Energy Advisor Mining 2013; Presenter BK Strategic Projects Manager Mining 2012

[97] Presenter AT Sustainability Analyst Manufacturing 2011

[98] Presenter CA Environmental Manager Transport 2012

included:

- finance and accounting personnel involved in decisions on financing energy management projects[99]
- production planners, who made decisions on production scheduling,[100] and
- facility managers involved in the daily operation of buildings.[101]

A Project Manager for Energy Efficiency in the manufacturing sector explained his approach in the following way:

> "I get 40 minutes to go in and talk about energy efficiency in our induction training program for all new employees. I start off by asking: If you walked past a tap that was running as you were heading into this meeting, who would stop and turn it off? Everyone puts up their hand. But, when I ask them whether they would turn off a light in an office if it was on and there was no one in the office, they mostly say no. So I let them know that energy pouring out of the light globe costs us more than the water pouring out of the tap." [102]

One of the reasons that external consultants and engineering personnel found it difficult to obtain input from personnel in organisations is that energy had not been perceived as a legitimate activity for many personnel to spend time on.[103] An Environmental Manager in the transport sector explained that a contributing factor in his organisation was that energy was effectively treated as a fixed cost which meant that it was assumed that it was not worth making any effort to save energy.[104]

Corporate energy practitioners developed a range of strategies to broaden awareness of the importance of energy efficiency in their organisations (see Table 8.2). One method was to develop an organisation-wide communication program.

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[99] Presenter AF Group Environment Manager Mining 2011

[100] Presenter AL Energy Project Engineer Manufacturing 2011

[101] Case DH GPT Group Commercial Sector 2012; Case DI Spotless Commercial Sector 2012

[102] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

[103] Presenter BA Sustainability Manager Multi Sector 2011; Presenter BB Energy Champion Manufacturing 2011; Presenter BO Energy Analyst Manufacturing 2012

[104] Interviewee CO Environmental Manager Transport 2013

Communication programs were typically developed with the HR or internal communications teams within organisations[105]. Communication media included the use of videos,[106]posters[107]and information sessions.[108] Communication strategies included providing information about the actions people could take on energy efficiency, as well as broader messaging explaining how energy management, together with other environmental initiatives, were a priority for the organisation as a whole. A Project Manager for Energy Efficiency in a manufacturing organisation explained the aim of the organisations energy efficiency communication strategy as making energy efficiency a consistent part of day-to-day decision-making:

> "Am I doing something safely? Am I doing it at the quality that the consumer wants? These are the two key things that people take for granted. Our people don't have to stop and think about it. The third one should be to ask: 'Am I doing it in an efficient way?' My aim is for energy efficiency to be the third natural instinct in our organisation."[109]

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[105] Presenter CA Environmental Manager Transport 2012; Presenter CG Manager Sustainability & Energy Manufacturing 2012

[106] Presenter AM Head of Sustainability Commercial 2011

[107] Presenter AJ Principal Energy Efficiency Engineer Manufacturing 2011

[108] Presenter AK Manager Climate Change & Environment Commercial 2011

[109] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

Table 8.2: Mechanisms to communicate energy performance

Mechanism	Description
Organisation-wide communication programs	Use of videos, posters and other channels to communicate the importance of energy management to the business[110]
Clubs	Creation of a social network to provide formal acknowledgement and a peer-to-peer network to support staff who did not have a formal energy management role[111]
Rewards and recognition	Senior management acknowledgement of outstanding performance[112]
Education and training	Specific information about the actions that could be taken in core business operations[113]
Reporting	Use of regular communication media within the firm to communicate performance[114]

The use of a 'green club' is illustrated in Box 8.3 as an example of one way in which attempts were made to engage staff in reducing energy and greenhouse gas emissions.

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[110] Presenter AM Head of Sustainability Commercial 2011

[111] Presenter AJ Principal Energy Efficiency Engineer Manufacturing 2011; Presenter CA Environmental Manager Transport 2012

[112] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

[113] Presenter BA Sustainability Manager Multi Sector 2011

[114] Presenter BI Greenhouse & Energy Advisor Mining 2012; Presenter BM Greenhouse & Energy Advisor Manufacturing 2012

Box 8.3: Communication strategies in a transport organisation
An organisation in the transport industry had developed a cartoon character that acted as a mascot for their energy efficiency and sustainability program. The 'personality' that was developed for the character was intended to create the idea that implementing green initiatives, including reducing greenhouse gas emissions through energy efficiency, was a smart and socially responsible thing to do.
The communication program was supported by staff information sessions, awards for successful ideas that were put forward by staff and a 'green club' was established. The idea of the green club was to create a positive social network of people who could share their ideas and challenges associated with progressing energy efficiency in their organisation. According to the Environmental Manager who founded the program, the social network became something that people wanted to belong to.[115]

The design of energy efficiency communication strategies varied from one organisation to the next. Although many organisations used community awareness and concern about climate change as a means of engaging staff, this approach was not universal. In part, the 'main messages' that formed the focus of communication programs were influenced by each company's culture, business objectives and the extent to which they considered energy efficiency to be viewed by their stakeholders as an issue associated with the reputation of the organisation overall.[116] The importance of aligning communication with the corporate culture and expectations of various internal stakeholders is reflected in the following quote from an Energy Coordinator in the mining industry:

[115] Interviewee CO Environmental Manager Transport 2013

[116] Presenter AA GM Carbon & Energy Mining 2011; Presenter AM Head of Sustainability Commercial 2011; Presenter CA Environmental Manager Transport 2012; Presenter CG Manager Sustainability & Energy Manufacturing 2012

> "There is nothing more frightening than going into a meeting room with a bunch of miners at six in the morning and talking about energy efficiency … I'd rather face the Board! But this is where it all happens – you have to engage with these core people on site. For example, we always talk to surveyors about energy efficiency in terms of bench movements, ore movements and how projects are going; whether the project involves a diesel additive or a new set of tyres or realigning a haul road. These guys are integral to making sure your projects are implemented and accurately reported."[117]

Broad-based communication programs reinforced the work of teams and energy practitioners and provided a broad level of interest in energy management. However, corporate energy practitioners often found it challenging to define the specific actions that could be taken by staff involved in core production or maintenance activities.[118] This has required detailed work to identify specific actions and procedures that should be taken within the day-to-day activities of these staff.
For example, one manufacturing organisation had been developing an education and training program for production planners. The Project Manager for Energy Efficiency identified that planners had many different criteria to consider when they did their scheduling. However, energy had not been one of them. The organisation is now developing a detailed training program demonstrating how production planning decisions impact on energy efficiency. This has required detailed energy data and analysis to determine the potential impacts. Until this data was available the organisation was unable to finalise the training program and had limited success influencing the activities of program planners.[119] This example highlights the time and resources required to make energy efficiency relevant to, in this case, production planners. It also highlights that communication programs often evolve over time – a point made by many corporate energy practitioners.[120]

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[117] Presenter BD Energy Coordinator Mining 2011

[118] Presenter BC Superintendent Energy Mining 2011; Presenter BH Energy & Carbon Manager Commercial 2012

[119] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

[120] For example: Case DG Woolworths Commercial Sector 2012; Presenter AP Energy & Sustainability Manager Commercial 2011; Presenter BL Manager Sustainability Commercial 2012

The need for an appropriate level of data was also demonstrated by companies in the transport sector. One organisation found that it had multiple operators driving the same trucks each week. Without the appropriate level of detailed energy data it was difficult to link individual behaviour to fuel consumption. As a result, the first iteration of the organisation's training program was quite broad. However, once more comprehensive fuel monitoring systems became available, the training was revised to incorporate the data and the new procedures associated with reviewing the data on a shift-by-shift basis.[121]

Rather than simply telling site managers and their teams what they had to do to meet the compliance requirements, corporate energy practitioners found that they could be more successful in building support for energy efficiency at the site level by reframing the risks and opportunities associated with energy management in ways that were carefully targeted at the current issues and priorities on each of the sites.[122] For example, the performance of one site was being impacted by the reliability of the site's operating equipment. This meant that frequent breakdowns were impacting on site production targets. By framing the energy efficiency assessment as a means of examining and identifying opportunities to improve reliability of equipment *as well as* identifying energy cost savings, the site management team was motivated to be involved in the assessment since they saw it as an opportunity, rather than simply a compliance obligation.[123]

Often the most effective ways of reframing the benefits for a particular site were not immediately obvious to corporate energy practitioners when they first commenced assessments under the EEO legislation. However, as they worked more closely with operational staff and managers, they came to understand how best to communicate the benefits of the energy efficiency assessment process in ways that were considered to be more relevant to site managers and key site-based staff. A Manager

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[121] Interviewee CN Business Development Manager Transport 2013

[122] Presenter AH Manager Greenhouse & Sustainability Mining 2011; Presenter BA Sustainability Manager Multi Sector 2011; Presenter CD Environmental Sustainability Manager Commercial 2012

[123] Presenter BP Group Sustainability Manager Manufacturing 2012

for Sustainable Building Operations in a commercial organisation explains:

> “We had a team (based in a capital city working closely with the on-site guys to monitor progress) that put together the business case for energy efficient building upgrades and ‘what have you’. We found that it worked very well for us. The consistency of having a professional working with the building manager on site and staying with that building for a number of years and setting the targets each year was one of the big advantages that we had – this ongoing consistency. It also meant that we had consistent communication with the asset managers who make decisions about investment in properties. They started to understand our efficiency language and we would also get to understand their language of return on investment, lease profiles and lease expires. I have learnt all of that by spending time talking to asset managers, and it meant that were talking about wider value to the business, rather than just cost savings from efficiency.”[124]

This example highlights how energy management professionals, whether they are based within an organisation or externally (as consultants), may limit their influence and effectiveness by focusing solely on energy savings benefits. However, the quote suggests that it can take time and experience with a particular building or site to fully understand the potential benefits. It also requires collaboration between other personnel with specific site or business experience to establish the complete range of benefits. This example suggests that the solution to this requires collaboration across professional boundaries over time in order to create new understanding and meaning associated with the value of energy management.

In summary, a range of communication strategies were used to promote energy efficiency more widely across organisations. Energy management was typically communicated as an activity that aligned with the organisations’ wider business goals and values. This helped to broaden interest and action on energy management beyond those individuals who had a formal role. Creating social networks, peer-to-

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[124] Interviewee CK Sustainability Manager Commercial 2013

peer support and learning was considered an important way of maintaining interest and enthusiasm. Ultimately, these programs reinforced other activities, such as the use of formal energy management teams. Communication programs developed over time as more detailed data, information and understanding of the relevance of energy management to individuals and groups across the organisation evolved.

8.2.3 Establishing site energy champions

Corporate energy practitioners explained that corporate-level energy and environmental staff are often perceived by site-level managers as presenting unhelpful constraints on site-level efforts to meet mainstream and core business objectives.[125] As a relatively new initiative, energy efficiency was competing with a range of other corporate programs and priorities for attention and resources. A Principal for Climate Change Energy Efficiency in the mining sector described the challenge in the following way:

> "… the sites often see the regional office driving multiple initiatives. For them, introducing a new initiative is just about more noise and distraction. Trying to get buy-in is a real challenge and that stems back to trying to sell the business case to the sites."[126]

Other factors contributing to these difficulties were time and geographical constraints, since respondents typically had oversight of a number of sites and were located in a capital city head office.[127] To address this challenge, corporate energy practitioners typically allocated responsibility to locally-based site energy practitioners – often referred to as 'site-based energy champions'.[128] In many cases, however, allocation of responsibility did not happen automatically, and required careful negotiation with site management as they were the ones who would have to provide the funding and allocate the time for the site-based energy champion to

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[125] Presenter AL Energy Project Engineer Manufacturing 2011; Presenter BB Energy Champion Manufacturing 2011; Presenter CG Manager Sustainability & Energy Manufacturing 2012

[126] Interviewee CL Principal Climate Change and Energy Efficiency Mining 2013

[127] Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Presenter BN Carbon Policy Manager Manufacturing 2012; Presenter BO Energy Analyst Manufacturing 2012

[128] Presenter AD Principal Greenhouse & Energy Manufacturing 2011; Presenter BB Energy Champion Manufacturing 2011; Presenter AL Energy Project Engineer Manufacturing 2011

focus on energy efficiency. Reframing the benefits – to highlight the operational, maintenance and productivity benefits, *as well as* energy cost savings, played an important part in this process.[129] Selecting the appropriate person at a site was important. A Project Manager for Energy Efficiency in a manufacturing organisation describes the characteristics that they were seeking in a site-based energy champion:

> "There are three important criteria for successful energy champions at our sites. First, they have got to be passionate about energy efficiency. Then, they have got to have good respect from their peers – otherwise they can't sell it. And third, they have got to make time to do it. The site leadership team also has to make time available for them to do it. And so these are the requirements – not their technical background necessarily. Sometimes plant accountants are the best ones to be energy champions because it is all about the money. We have an energy engineer at two sites. At another site we have one of our electrical managers and at our agricultural business we have the engineering manager. So their background varies, but they all have to be passionate, have respect and they have to be able to make time to do it."[130]

These characteristics highlight the important role that the site-based energy champion plays in promoting energy management across the site. Since they are located on site, the site-based energy champions are able to more frequently and easily use existing formal communication channels to promote energy management.[131] Informal networks at the site level were also considered to be important since site-based energy champions played an important role in motivating their peers to contribute time and effort to energy efficiency improvement.[132] Of significance is the comment in the quote above that site-based energy champions may not necessarily have a technical engineering background. The corporate energy practitioner implies in this quote that the appropriate background of a site-based energy champion depends on the needs and culture of the site. According to this

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[129] Presenter BC Superintendent Energy Mining 2011

[130] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

[131] Presenter AI Maintenance Superintendent Transport 2011

[132] Presenter AL Energy Project Engineer Manufacturing 2011

respondent a site-based energy champion needs to be an effective communicator that is able to motivate others. This was emphasised by a majority of other respondents as well.[133]

Many organisations were also able to create a powerful community of practice through which the experience and lessons learnt about energy efficiency could be shared across an organisation. For example, corporate energy practitioners would convene formal meetings of site-based energy champions.[134] These meetings would provide the energy champions with an opportunity to share their experiences of what had worked and what had not on each site and to learn from each other's experience. Formal and information communications between site-based energy champions were also encouraged. The liaison across site-based energy champions also helped to develop new energy management practices and encourage those practices to be applied across all of the organisations sites. Such practices included those associated with the way in which performance was reported, technical analysis was conducted and energy efficiency measures were developed and rolled out more widely.[135] The learning between site-based energy champions was not just about technical initiatives, it also included learning about how to most effectively influence internal stakeholders.[136] Collaboration also provided an important support network for champions that helped to reinforce the importance of their role and to acknowledge any difficulties. This was important, because they were often involved in promoting activities at their sites (and activities that were not necessarily established as a legitimate and ongoing business practice). Support from personnel facing similar challenges helped to increase morale amongst site-based energy champions.[137]

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[133] Interviewee CP Project Manager Energy Efficiency Manufacturing 2013

[134] Interviewee CQ Principal Energy Advisor Mining 2013; Presenter CE Energy Manager Mining 2012

[135] Interviewee CQ Principal Energy Advisor Mining 2013; Presenter AD Principal Greenhouse & Energy Manufacturing 2011; Presenter BR Energy Manager Utilities 2012

[136] Interviewee CQ Principal Energy Advisor Mining 2013

[137] Interviewee CQ Principal Energy Advisor Mining 2013; Presenter BI Greenhouse & Energy Advisor Mining 2012; Presenter BM Greenhouse & Energy Advisor Manufacturing 2012; Presenter BR Energy Manager Utilities 2012

8.2.4 Section summary

This section of the case research has described the energy management practices that organisations involved in the research have applied to improve the level of involvement and engagement of internal personnel. The key practices were:

- forming and managing cross functional energy management teams
- developing communication programs to promote the benefits of energy efficiency and actions that staff could take in order to contribute to energy efficiency improvement, and
- establishing energy champions at the site level.

Corporate energy practitioners faced a number of challenges in broadening the involvement of personnel. For example, they needed to convince management that the investment and time required to involve others would be beneficial. Even with the support of management, however, they had to encourage personnel to become involved. Corporate energy practitioners modified the way in which they communicated the benefits of energy efficiency to build support and engagement by reframing the benefits in a manner that was most appealing to the particular stakeholder group they were attempting to influence.

8.3 Theme 2 – Developing energy information systems

8.3.1 Introduction and background

The uses and consumption of energy within organisations are complex and can be influenced by multiple factors,[138] some of which are controllable (e.g. decisions about equipment purchased and the way in which the equipment is used). Other factors are outside the organisation's control (e.g. more energy is required to air condition an office environment on a hot day, when compared with a cool day). Due to the complexity of energy use, corporate energy practitioners explained that access to accurate and reliable energy data is an essential aspect of effective energy

[138] The information presented in this paragraph is drawn from a range of presentations. It reflects the general understanding expressed by both government and industry personnel at the annual conferences.

management. Energy data needs to be accessible, accurate and reliable. Also, different levels of data are required (e.g. across the organisation as a whole, at the level of individual sites and at the level of single items of equipment and particular operating processes). The usefulness of energy data also depends on the frequency with which it is collected and the form in which it is made available to energy users. Energy data can be obtained in different ways, including through fixed energy meters or obtained manually by using specialist tools. Software systems are typically used to convert raw data into meaningful information. The sophistication of the software used can vary from a simple spreadsheet to customised energy management software that may also be linked to financial and operational data.

The term ‘energy information system’ is used here to describe the development of a system that supports the collection, interpretation and reporting of energy data in order to “measure and maintain performance and to locate opportunities for reducing energy consumption and cost” (Swords, Colyle & Norton 2008, p. 61) and to deliver other business benefits.

Prior to the introduction of the EEO legislation in 2006, energy management had typically received relatively limited management attention in the majority of the respondent organisations. Corporate energy practitioners explained that they inherited energy information systems with significant limitations. Typically issues included the following:

- There was limited energy data available.[139]
- The accuracy of the available data was highly variable.[140]
- Where data was available, it was often in a form that was difficult to access and interpret.[141]

[139] Case CV Downer EDI Mining Sector 2012; Presenter AS Chief Financial Officer Commercial 2011; Presenter BH Energy & Carbon Manager Commercial 2012

[140] Presenter AY Senior Consultant Manufacturing 2011; Presenter BC Superintendent Energy Mining 2011; Presenter BG Senior Consultant Mining 2011

[141] Presenter AN Director Consultancy Commercial 2011; Presenter AO Director Consultancy Commercial 2011; Presenter AP Energy & Sustainability Manager Commercial 2011

Figure 8.2 illustrates the various factors that respondents described which made it difficult for them to obtain the investment required to improve their existing energy information systems. At the project level, corporate energy practitioners explained that limited access to appropriate data led them to believe that a number of potential improvement opportunities were being overlooked. This meant that limited energy projects were identified[142] (see Box 1 in Figure 8.2). With regard to the projects proposed as potential improvement opportunities, a number of these were not progressed where there was insufficient data available to accurately establish the financial costs and benefits associated with the implementation of these projects[143] (see Box 2 in Figure 8.2). This, in turn, limited the overall business benefits that were achieved through the energy efficiency assessments (see Box 3 in Figure 8.2).

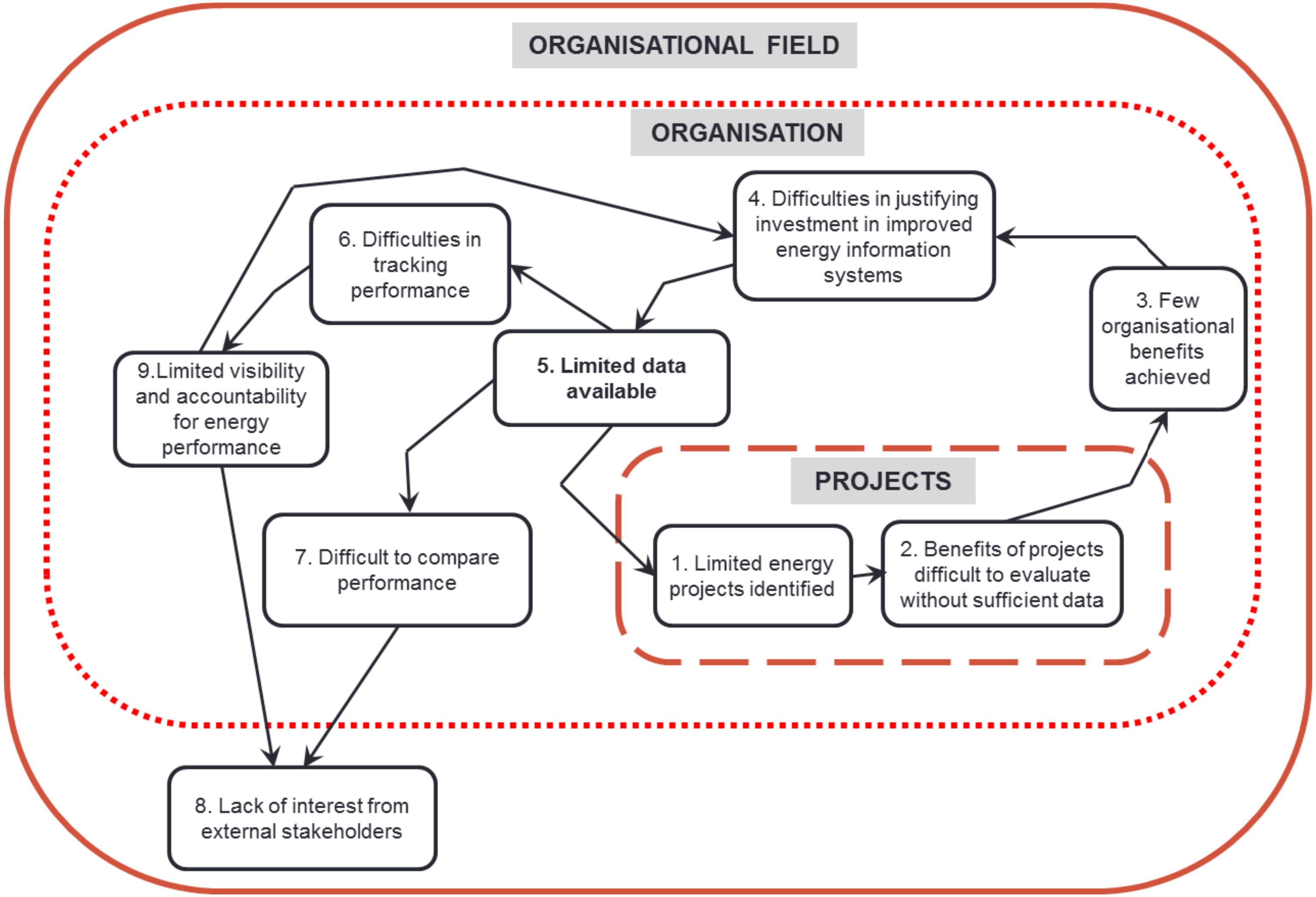
The lack of benefits then made it difficult to justify the investment required to improve energy information systems[144] (see Box 4 in Figure 8.2). This created a negative feedback cycle that maintained a situation in which it was very difficult to justify investment to improve the energy information system (see Box 5 in Figure 8.2).

[142] Presenter AF Group Environment Manager Mining 2011; Presenter AS Chief Financial Officer Commercial 2011

[143] Presenter AA GM Carbon & Energy Mining 2011; Presenter AY Senior Consultant Manufacturing 2011

[144] Presenter AX Senior Consultant Transport 2011; Presenter BC Superintendent Energy Mining 2011

Figure 8.2: Challenges associated with improving energy information systems



At the organisational level, the lack of available energy data made it difficult to track energy performance of the organisation over time (see Box 6 in Figure 8.2) and to compare performance of the organisation with others in the same industry sector[145] (see Box 7 in Figure 8.2). This meant that there was limited visibility and accountability for energy performance within the organisation (see Box 9 in Figure 8.2). Without this information, it was difficult for external stakeholders to compare and influence organisations when it came to energy efficiency performance improvement (see Box 8 in Figure 8.2). This situation reinforced the difficulty in justifying the investment required to further improve an organisation's energy information systems[146] (see Box 5 in Figure 8.2).

The EEO legislation requires organisations to identify and evaluate projects to a degree that provides decision-makers with 'investment quality' information (RET 2011). However, corporate energy practitioners explained that the specific compliance requirements outlined in the EEO legislation were not well understood at the time when the first energy efficiency assessments were being undertaken.[147] The limitations of existing energy information systems became more apparent as subsequent energy efficiency assessments were undertaken and as companies began to realise that they may not meet the compliance requirements of the EEO legislation. Such requirements included identified projects needing to be evaluated to a level of accuracy of ±30% (RET 2011).

Respondents explained that it was easier to justify improvements to the way in which energy data was gathered at a higher level, such as overall site energy use, relative to obtaining detailed energy use data at the sub-system or equipment level within a site.[148] Corporate energy practitioners explained that growing interest on the part of stakeholders external to their organisation provided an important motivation to

[145] Presenter BD Energy Coordinator Mining 2011; Presenter BE Product Manager Mining 2011

[146] Presenter AI Maintenance Superintendent Transport 2011; Presenter AO Director Consultancy Commercial 2011

[147] Interviewee CS Carbon and Energy Manager Mining 2013; Presenter AY Senior Consultant Manufacturing 2011

[148] Presenter AW Group & Risk Sustainability Manager Multi Sector 2011; Presenter BB Energy Champion Manufacturing 2011; Presenter BC Superintendent Energy Mining 2011

improve the quality and availability of energy data at the highest level, being total energy use for the organisation and the facilities within it.[149] However, these same external drivers for change did not directly support the development of energy information systems at a more detailed level (e.g. the level of an item of equipment or a specific production line). These differences are discussed separately in the following two sections – beginning with an examination of the strategies applied to improve data at the organisation and site levels.

8.3.2 **Tracking and reporting enterprise-wide energy use**

As discussed previously in this case study, the EEO legislation was an important trigger for organisations to review and (eventually) modify their energy management practices. However, subsequent to the introduction of the EEO legislation, the importance of energy management was reinforced through the influence of other organisational stakeholders, including investors and customers. The interest and needs of these other stakeholders provided an important driver for organisations to improve the quality and accessibility of organisational and site-level energy data. These drivers included the introduction of the NGER Act, which was introduced 12 months after the commencement of the EEO legislation (See Table 7.3 in Chapter 7). Practitioners also explained that they faced a number of other reporting requirements. These requirements included investors requesting information through reporting projects (e.g. the carbon disclosure project) and investor surveys about organisational sustainability performance.[150] Reducing the costs of managing the data to meet these external requirements and managing the potential risks of reporting data that was incorrect provided an important motivation for organisations to establish more effective energy information systems.

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[149] Presenter AD Principal Greenhouse & Energy Manufacturing 2011; Presenter AT Sustainability Analyst Manufacturing 2011

[150] Interviewee CQ Principal Energy Advisor Mining 2013; Presenter AD Principal Greenhouse & Energy Manufacturing 2011; Presenter AM Head of Sustainability Commercial 2011; Presenter BM Greenhouse & Energy Advisor Manufacturing 2012

As a General Manager of Carbon and Energy in a mining company explained:

> "We had people out there collecting data three times – for National Pollutant Inventory reporting, National Greenhouse and Energy Reporting and EEO. Eight people were pulling the same sort of stuff together. So we had to do something about it and it's all coming together now. Anyone who needs it can come to the one place and pull it all out, and it's comprehensive and it's easy to use."[151]

Large energy consumers also began to use contract negotiations with energy retailers to obtain more detailed energy data.[152] Rather than monthly or quarterly billing data, organisations began to obtain more frequent interval data. For example, energy use for a facility could, in many cases, be provided on a 15-minute basis and in an electronic format. As well as reducing the administrative costs associated with collecting and aggregating data,[153] the availability of this data supported analysis of energy use at different times of the day, and from one day to the next.[154] This type of analysis helped to highlight potential areas in which energy was being used unnecessarily. An unintended, yet useful consequence of more frequent reviews of energy data was that many organisations identified mistakes in the billing data which they were able to rectify and have excess payments reimbursed. Opportunities to modify their tariff structure also delivered cost savings on subsequent energy bills.[155] These cost savings provided corporate energy practitioners with early 'wins' since they could clearly demonstrate that money was being saved by implementing more sophisticated energy information systems.

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[151] Presenter AA GM Carbon & Energy Mining 2011

[152] Interviewee CO Environmental Manager Transport 2013

[153] Presenter AW Group & Risk Sustainability Manager Multi Sector 2011

[154] Presenter AU Infrastructure Capability Manager Manufacturing 2011

[155] Examples include: Presenter AF Group Environment Manager Mining 2011; Presenter AW Group & Risk Sustainability Manager Multi Sector 2011; Presenter BR Energy Manager Utilities 2012

8.3.3 Developing energy performance measures

The commercial office sector

Respondents explained that one of the major challenges for energy management is that it is difficult to compare the energy efficiency performance from one site or building to another. This is because there are multiple factors that can impact on energy performance, including the age of particular sites,[156] the type of equipment used,[157] and the goods and services produced.[158] The challenge has been to develop performance measures that account for these differences to enable meaningful comparison. Developments in the commercial office sector provide an illustration of the way in which collaboration by multiple stakeholders over time is essential in order to develop meaningful measures of comparison that can be used to compare energy efficiency performance across commercial office buildings. This example is included in the analysis because it was mentioned frequently in presentations by corporate energy practitioners in the commercial sector as an important driver for change within their organisations.

The NABERS Energy rating tool was first developed in 1999 by the NSW Government. The involvement of building owners, tenants, technical consultants and government has helped to develop the credibility of the rating system to build confidence in the ratings system over time.[159]

Since 2010, it has become mandatory to use the rating system when commercial office space of 2000 square metres or more is offered for sale or lease (under the *Building Energy Efficiency Disclosure Act 2010* (Cth)). It is a performance-based tool, meaning that the rating is calculated on the basis of actual energy performance every 12 months. The tool allows for the normalisation of energy performance through consideration of building area, climate, hours of occupancy and equipment density. Ratings can be undertaken on a whole building, base building or tenancy. The outcomes are reported on a scale of one to six stars where 2.5–3 stars is

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[156] Presenter AU Infrastructure Capability Manager Manufacturing 2011

[157] Presenter CE Energy Manager Mining 2012

[158] Presenter AD Principal Greenhouse & Energy Manufacturing 2011

[159] Presenter AN Director Consultancy Commercial 2011

considered to be the average energy performance.[160]

The star rating systems of the NABERS Energy rating tool has provided building owners and tenants with an opportunity to compare the energy performance of buildings in a way that is easily communicated and easily understood by non-technical audiences. In 2006, the 'Energy Efficiency in Government Operations' policy (AGO 2007)established a requirement that all government leases undertaken for longer than two years needed to be located in buildings demonstrating a NABERS Energy rating of at least 4.5 stars. The standard was also applied to new office buildings and major refurbishments. This requirement, together with a growing number of businesses that were also using the rating systems as a way of comparing building performance, has created an important commercial driver of improved energy performance.[161]

The development of the NABERS Energy rating system has also helped building owners to establish portfolio-wide energy performance targets. The advantage of adopting a portfolio-wide target is that it provides greater flexibility in considering the most appropriate buildings in which energy efficiency investments should be made. For example, energy efficiency investments can be matched to the business and equipment life-cycle of buildings.[162] Practitioners have also found that it is much easier to justify equipment replacement when such equipment is due to be replaced. They have been able to argue that any marginal increase in capital cost associated with energy efficiency can not only deliver operational cost savings but also 'future-proof' the building against rising energy costs and increasing tenant demands for more efficient office space. Similarly, business cases/proposals for energy efficiency investments may be more successful when presented at the time in which an existing lease is being negotiated with energy efficiency improvement presented as a value add. Another opportunity for energy efficiency investment is when a large tenant vacates a building. Practitioners can argue that an energy efficiency upgrade to the

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[160] Mitchell 2009

[161] www.cbd.org, accessed July 2013

[162] Interviewee CK Sustainability Manager Commercial 2013; Presenter CD Environmental Sustainability Manager Commercial 2012

building can enhance the ability to attract future tenants. In some cases, energy efficiency upgrades can play a key role in repositioning a building in terms of both quality and reduced outgoings for tenants.[163] These examples highlight that it is important to have an ongoing focus on energy management since investment opportunities may be greater at these different times.

The widespread use and publication of portfolio-wide energy targets using energy ratings has also helped practitioners to more easily explain the energy performance of a portfolio to internal and external stakeholders. In recent years, the Chief Executive Officers of some large commercial building owners have received questions from investors about progress towards energy efficiency targets.[164] One of the reasons for this is that investors have become increasingly aware of and concerned about the capability for building owners to attract and retain tenants.[165] Benchmarking across a portfolio has also made it easier for energy practitioners to engage with financial staff, such as Asset Managers, because when they use the NABERS Energy rating system, they can more easily compare the performance of one building with another and present energy efficiency improvement options in terms of the increased rating that a building is likely to achieve once such investments are undertaken. In essence, the NABERS Energy rating has helped to create a common language for building energy performance that is accessible to owners, tenants and investors.[166]

While the NABERS Energy rating system supports comparison across buildings, it does not provide the detailed energy data that is required to identify potential energy efficiency improvement projects. Accurate, reliable and accessible data was found to become increasingly important as organisations found that they had to improve day

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[163] Case DH GPT Group Commercial Sector 2012; Case DJ National Australia Bank Commercial Sector 2012

[164] Interviewee CK Sustainability Manager Commercial 2013; Presenter AK Manager Climate Change & Environment Commercial 2011; Presenter AQ Sustainability Manager Commercial 2011

[165] Case DH GPT Group Commercial Sector 2012; Presenter AR Head of Finance Products Commercial 2011

[166] Interviewee CK Sustainability Manager Commercial 2013; Presenter AN Director Consultancy Commercial 2011; Presenter BU GM Sustainability Commercial 2012

to day operational performance as well as major capital upgrades to continue to obtain continuous improvement.[167]

The NABERS Energy example highlights the interaction between internal and external stakeholders in relation to establishing legitimate and widely-used measures of energy performance. These allow for credible (legitimate) comparisons to be made within organisations and by external stakeholders, including investors and customers.[168]

The NABERS Energy rating system supported a change in understanding of the value of energy efficiency. As the Sustainability Manager of a large commercial sector organisation explained:

> "For companies like ours with premium commercial buildings, energy efficiency had become synonymous with quality and value. It is as if the bar had been raised and it has become the norm that any "A grade" property has got to be highly efficient. And I think that maybe it is not so much that an efficient building means additional value, but that an inefficient building raises alarm bells in terms of the investment required to get it up to scratch."[169]

Mining sector example

In other industry sectors, comparison can be more challenging due to the multiple factors that influence energy use. For example, on mine sites large trucks transport material from the mine face to the processing plant. Energy use can be influenced by factors including the quality of the road, the way the truck is driven, the size of the load and the type of material being transported. Despite these challenges, one organisation developed and promoted a tool for comparing energy performance over time and from one site to another (see Box 8.4). Unlike the NABERS Energy tool

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[167] Presenter AP Energy & Sustainability Manager Commercial 2011; Presenter BT Sustainability Manager Commercial 2012

[168] Interviewee CK Sustainability Manager Commercial 2013; Presenter AN Director Consultancy Commercial 2011

[169] Interviewee CK Sustainability Manager Commercial 2013

which was an industry-wide development, this company, which was a mining contractor, developed a benchmarking tool in their corporate energy and greenhouse group. An important rationale supported the development of the benchmarking tool; the creators believed that it improved their competitiveness, as it provided a tangible example of their approach to innovation. It also highlighted their ability to reduce operating costs and support mine owners in meeting compliance requirements (e.g. NGER Scheme reporting) and to build their reputation.[170]

[170] Presenter AH Manager Greenhouse & Sustainability Mining 2011

Box 8.4: Developing a performance measure in the mining sector
One organisation (contract mining) with a strong in-house corporate technical team sought to better understand the variables that impacted on fuel consumption in order to develop a measure that could be used to compare and track performance. The technical team worked with a site which had a particularly strong culture of innovation. The first assessment under the EEO legislation was conducted on this site.

The technical team engaged with site-based operators, managers and technical staff with specific knowledge and developed a measure which enabled them to track performance at a refined level. The measure was sufficiently rigorous that it ultimately enabled them to incorporate performance bonuses into managerial remuneration programs.

Their motivation for doing this went well beyond compliance requirements. As a contract miner, they viewed their energy and greenhouse gas management as a key differentiator when bidding for mine operation projects. Therefore, the investment in time and effort was justified on a number of factors, including compliance, cost savings and future business growth. They also had a strong team and used a strategy of developing new initiatives on a site with a team that was particularly open to innovation.

Once techniques and practices were evaluated (those that were positive), they then implemented the successful initiatives across the organisation. In the case of the performance measure, this become part of an operating performance 'dashboard' of indicators that is communicated clearly on site alongside production performance and safety. [171]

[171] Case DO Downer EDI Mining Sector 2012

8.3.4 Improving the quality of project-level data

While the motivation to improve energy information at the organisation and site levels was driven by external compliance requirements and the interests of stakeholders, it was more challenging for corporate energy practitioners to justify investment in energy information systems at a more detailed or 'sub-level' of energy data[172].

The case in Box 8.5 illustrates how opportunities to upgrade technology to monitor fuel performance were able to be incorporated into a technology upgrade that was being undertaken for another purpose.

Box 8.5: Leveraging customer interest to enhance energy monitoring

A transport organisation had implemented a wide range of energy efficiency improvement initiatives. However, the cost of improved vehicle tracking technology and software that would provide data on the energy efficiency performance of their drivers could not be justified solely on the basis of any fuel savings that might be achieved.

When a long-term client's contract came up for renewal, the client required more sophisticated GPS tracking of their orders. This provided the transport organisation with the justification to make the significant investment that was required to upgrade existing technology. In their selection of technology they were also able to consider the requirements that would support appropriate feedback to the drivers.

This example also shows the important links between the company looking for improvement opportunities, but needing greater justification than could be achieved by a compliance requirement in its own right. They were also able to successfully 'piggy back' the energy efficiency improvement on another organisational priority.

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[172] Presenter AW Group & Risk Sustainability Manager Multi Sector 2011; Presenter BE Product Manager Mining 2011; Presenter BG Senior Consultant Mining 2011; Presenter BK Strategic Projects Manager Mining 2012

Another opportunistic example is demonstrated by the strategy employed to justify metering on a mining site. In this case, the justification for the metering came through linking the improvement to other business benefits.

Box 8.6: Justifying metering on a mine site

A site had power quality issues that were impacting on operations through unplanned plant downtime. A comprehensive business case proposal was developed over a six-month period, which was able to demonstrate production improvements as well as meet legislation requirements and support improved identification of energy efficiency projects.[173]

Improvement of detailed energy data was typically achieved on a progressive basis. This is illustrated in Box 8.7.

[173] Case DQ Rio Tinto Iron Ore Mining Sector 2012

Box 8.7: Adopting a progressive approach to data analysis

In response to the difficulties of clearly defining the required level of data and analysis that is undertaken as part of an assessment, many organisations have found that adopting an iterative approach to improving energy information systems has been a successful strategy. In one example where this approach was taken, a consultant presented a case study of an office building that was commissioned in 2004. It had been designed to meet a 4.5 star energy rating under the NABERS Energy rating scheme. However, after the first year of occupation, it was found to have achieved only 2.5 stars. The consultant was asked by the building owner to improve the energy performance of the building.

Using the available data, the consultant was able to achieve a 4 star performance. When the building owner made it clear that they required the consultant to achieve a 4.5 star rating, it was agreed that advanced energy monitoring equipment would be required. The client was able to justify this investment because of the savings achieved from the earlier energy efficiency work and also due to the pressures of management and external stakeholders to achieve a 4.5 star rating.

A 4.5 star rating was finally achieved 12 months after the installation of advanced energy monitoring equipment and analysis. The overall improvement from 2.5–4.5 stars took three years to achieve.[174]

The description of this process highlights a number of important points about energy efficiency improvement and energy information systems. First, there have been few clear guidelines or agreements on the level of data that is required in operations to identify, evaluate and implement opportunities. This is challenging because of the diversity of operations and the way in which energy is used within and across

[174] Presenter AN Director Consultancy Commercial 2011

industries.[175] Second, obtaining resources for improved metering is typically very difficult for energy efficiency practitioners.

One successful strategy has been to implement smaller projects and to use the positive results from these projects to justify investment in more sophisticated data and monitoring systems. Once achieved, the savings from the early work assist in justifying investment in improved monitoring equipment. As additional benefits are obtained from the improved monitoring equipment, the corporate energy practitioner is then in a position to justify further investment in energy information systems.[176]

These findings underscore the need for government policies and practitioner strategies that encourage continuous improvement over time, rather than expecting that a 'one off' energy efficiency assessment will lead to sufficiently improved energy information systems and the identification of all of the cost-effective energy efficiency measures that are available to an organisation.

8.3.5 Section summary

This section of the case research has described the energy management practices organisations have used to improve the way in which data is collected and interpreted. Such practices are used to measure, maintain and report on energy performance. The practices described have been associated with:

- tracking and reporting organisation-wide energy use
- establishing energy performance measures, and
- improving the quality of detailed energy data.

Corporate energy practitioners faced a number of challenges associated with improving energy information systems within their organisations. In particular, they found that it was difficult to justify the investment required to improve such systems due to the challenge of quantifying the resultant benefits. Improvements were typically made on a progressive basis over time. These were supported by legislative requirements and requests for information from other stakeholders, linking

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[175] Presenter BH Energy & Carbon Manager Commercial 2012; Presenter BL Manager Sustainability Commercial 2012

[176] Presenter AN Director Consultancy Commercial 2011; Presenter BC Superintendent Energy Mining 2011; Presenter BG Senior Consultant Mining 2011

improvements in energy monitoring to operational or customer benefits. In addition, successful results were communicated as a means of demonstrating the benefits of improved energy data and justifying further investment in energy information systems.

8.4 Theme 3 – Identifying potential projects

8.4.1 Introduction

As described earlier in this case study, organisations have traditionally sought to identify energy efficiency improvement options through energy efficiency assessments. Assessments were typically:

- conducted once every three to five years
- heavily reliant on the expertise and resources of an external energy consultant, and
- concluded with a report that listed the costs and benefits associated with potential energy efficiency projects.

This section of the case describes the key changes that organisations made in the way energy efficiency projects were identified. The three practices examined in this section include:

1. improving energy efficiency assessments
2. identifying opportunities in real time, and
3. gaining support to implement projects.

8.4.2 Improving energy efficiency assessments

Adapting from one site assessment to the next

The EEO legislation allows organisations to schedule their site-based energy efficiency assessments across a five-year 'assessment cycle'.[177] This feature of the program provides organisations with an opportunity to improve their approach to conducting energy assessments from one assessment to the next. It also allows organisations to spread the resource requirements over a number of years, rather than requiring them to complete all site assessments in a short period of time.

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[177] Interviewee CM Climate Change & Resource Efficiency Manager Multi Sector 2013; Interviewee CQ Principal Energy Advisor Mining 2013

Organisations have taken advantage of this design feature to adapt their approach to conducting assessments over time. Boxes 8.8 and 8.9 present two examples.

Box 8.8: Sequencing assessments to improve results (example)
An organisation in the mining sector chose to conduct their first energy efficiency assessment under the EEO legislation on a site that had a reputation for approaching new business initiatives in a proactive and innovative way. Working with a site that was receptive to innovation and change was an effective way to obtain good outcomes from the first assessment. Since the site had a proactive organisational culture, site personnel were motivated to reflect on the assessment process and to identify any actions that they could take to improve it.

Once the site achieved tangible outcomes, the Manager for Greenhouse and Sustainability used the positive outcomes to suggest changes to the assessment process to influence the way in which other sites conducted assessments.[178]

The site involved in the example presented in Box 8.8 became a 'test-bed' for innovation. Personnel would carefully monitor the results from new projects. If a project demonstrated sufficient benefits, then the Manager for Greenhouse and Sustainability would share the information with other sites.

This highlights the important role that corporate energy practitioners can play in sharing lessons learnt from one site to another.

[178] Presenter AH Manager Greenhouse & Sustainability Mining 2011

Box 8.9: Developing an assessment tool to improve the effectiveness of assessments (example)

An Energy Efficiency Engineer in a manufacturing organisation explained that the organisation had initially contracted a consultant to conduct assessments on each of the organisation's sites. Several limitations of this approach (with regard to identifying opportunities) became apparent after the first few assessments. For example:

- Since sites varied significantly in size and complexity, some required more resources than others to conduct a comprehensive assessment. However, the same assessment resources and time were allocated to each site.
- Site personnel found that the assessments were too broad and there was little opportunity to investigate particular areas of opportunity in detail.
- Management did not allocate sufficient resources to establish the costs and benefits for specific projects. This process could take from several months to a year for each project depending on the complexity of a project.
- Sites did not share information about their assessments with other sites. This meant that similar problems were repeated.

The Energy Efficiency Engineer worked with a consultant and site personnel to develop an 'energy efficiency assessment tool' to help address these limitations. To use the tool, site assessments teams first segmented the site's operations according to key technologies and process areas. These were the key focus areas. Specific manufacturing lines or compressed air systems (for example) were separate focus areas. The assessment team allocated the time and resources required to investigate each focus area and scheduled the time for the assessment of each focus area into a compliance calendar. The complete assessment schedule for a complex site could be a number of years if the site had a large number of focus areas.

The tool featured a set of common questions relevant to each focus area. Assessment teams at each site would update the questions and information in the tool throughout an assessment. In this way, the tool played an important role in sharing information and knowledge from one site to another. Other benefits of this approach included that relevant internal personnel would only need to be involved in the focus areas for which they had appropriate expertise. Also, detailed investigations of particular project ideas would be staggered over time, rather than having to be completed in one go.[179]

Improving the way in which personnel, consultants and suppliers were involved in assessments

The majority of respondents explained that they had modified their approach to selecting and involving people in assessments. In particular, the majority of organisations modified the role and scope of work undertaken by external consultants. The Principal Advisor in a mining organisation explained his experience:

> "We got people from the site involved in the room for a workshop, but the consultants were very much controlling it. A lot of the ideas came directly from the consultants. They would say 'we are here to do an assessment and identify all these opportunities, and what do you think of this opportunity or that opportunity'. We tried to allocate projects for people to follow up, but it just went nowhere. The ideas that were being generated were getting absolutely no traction. Most of the ideas that were discussed at the workshop would just get abandoned. So, early on it was very heavily weighted towards a consultant doing the work and us being receivers of the work. That continued for probably the first four assessments. It was very much 90% consultant input and 10% from us. But then slowly, we started to realise that this wasn't a particularly good way to do it."[180]

As the quote above highlights, the Principal Advisor believed that involving a range of personnel in a 'brainstorming' workshop was not sufficient to obtain good results from the assessment. It required a different approach. In the example presented below, the organisation modified their approach to assessments. They still used consultants; however, their role was to provide input on the generic energy-related

[179] Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013

[180] Interviewee CQ Principal Energy Advisor Mining 2013

technologies with which they were most familiar. The role of the consultant was to facilitate the process, rather than to identify and evaluate the full suite of projects that might be available to the site.

The Principal Energy Advisor described why it is essential to involve personnel with specific site experience as well as technical expertise:

> "It might seem logical that if you have two secondary crushers then you could turn one off. In the past, that idea would have been rejected because it would create other production problems. But, because that idea started getting discussed broadly amongst the engineers, we had people coming back to us and saying: 'look, there are issues about vibrations, if you turn one off and keep the other one going then the vibrations cause problems. Perhaps what we can do instead is run the other one at a really low speed. It will still be turning over, but it won't be using as much electricity'. That sort of dialogue … that sort of 'care factor' … we just didn't have in the earlier assessments."[181]

This quote illustrates the importance of involving experienced site personnel who are closely involved in the process of identifying and evaluating energy efficiency projects. They can:

- highlight the operational issues that need to be considered when evaluating the suitability of a particular project or operational change
- contribute in-depth knowledge and experience about specific equipment and operating processes (This knowledge is not necessarily available from external experts, and is typically not available from energy consultants with broad energy rather than operational experience.)
- contribute to the development of business case proposals by ensuring that the operational risks are accounted for in preparing a project proposal.[182]

[181] Interviewee CQ Principal Energy Advisor Mining 2013

[182] Case CV Downer EDI Mining Sector 2012; Case DD Xstrata Copper Manufacturing Sector 2007; Case DM Foster's Group Manufacturing Sector 2012

This example also suggests that just having key personnel involved in a workshop may not be sufficient to obtain their input – particularly if participants do not have the 'care factor' required to make the effort necessary to change existing operational practices.

Another limitation of the use of consultants was that they often did not have the specific business knowledge that was required to engage personnel – particularly site managers. One practitioner explained that this had happened at one site when the consultants had presented to the site management team. Since that time, the consultants have always presented to important business stakeholders in conjunction with the corporate energy manager to improve the credibility of the energy efficiency work by linking the requirements and outcomes more clearly into the business case and drivers.[183]

Understanding how to best to use external consultants has evolved for organisations through the process of conducting assessments. This was in part driven by the requirements of the EEO legislation to engage and involve a range of expertise in assessments. As energy efficiency practitioners also developed a better understanding of the requirements, they also became less reliant on external energy consultants.[184] This was further supported through networking with other companies at annual conference events organised by the Department of RET.[185]

Another important stakeholder group not traditionally involved in energy efficiency assessments was that of equipment suppliers. Box 8.10 illustrates a novel approach by one organisation to involve suppliers in their energy efficiency assessment.
The quote reflects an attempt to engage personnel more widely in the process of identifying and evaluating opportunities; however, it shows that having the appropriate people in the room is not sufficient in its own right to engage with and

[183] Interviewee CL Principal Climate Change and Energy Efficiency Mining 2013

[184] Presenter AD Principal Greenhouse & Energy Manufacturing 2011; Presenter AE Energy Engineer Manufacturing 2011; Presenter AT Sustainability Analyst Manufacturing 2011; Presenter BA Sustainability Manager Multi Sector 2011

[185] Presenter AA GM Carbon & Energy Mining 2011; Presenter AW Group & Risk Sustainability Manager Multi Sector 2011; Presenter CD Environmental Sustainability Manager Commercial 2012

build ownership for energy efficiency improvement.

Box 8.10: Involving suppliers in assessments (example)

One group of stakeholders that have not been widely involved in energy efficiency assessments are suppliers. This was recognised as an issue by a corporate energy practitioner in a mining organisation as they reflected on how to improve the effectiveness of their assessment processes in the second cycle of assessments. It came about through the experience of the initial assessments, which had led to a better understanding of the sources of information on projects.

Specifically, there was a disconnect between the information available to suppliers and their willingness to provide it to the consultant involved in conducting an energy efficiency assessment, as set out below:

> "The external consultant says: 'what do you think about using this technology?' The site says: 'Yes, it is worth exploring further'.
>
> The external consultant tries to get costs from the supplier, but the supplier is reluctant to give them detailed costs. So the external consultant has to guess costs.
>
> This means we don't get a realistic evaluation of the project and so it doesn't provide the basis for investment decisions."

Prior to conducting energy efficiency assessments at the site level, the corporate energy practitioner arranged a two-day workshop in which suppliers presented the latest information on energy efficient products that they could supply. Site-level energy champions and operational staff, together with corporate technical and procurement personnel were also involved in the workshops. Following a presentation by a particular supplier, the workshop participants could ask them questions about their technology. They would then explore the potential ideas for improvement in smaller groups that included suppliers and other sites.

The suppliers found that they now had an important connection into the sites, they understood that energy efficiency was a priority for the organisation and they had clearer lines of communication through which to promote these projects.

For the site-level energy champions, the workshop provided important input into their site-based assessments. This background work highlighted areas of potential opportunity as well as areas that were not worth examining further. They had also made better contacts and connections back to the corporate groups involved in procurement, operations and asset management. This saved time and effort that had been lost in the previous assessment when site personnel or consultants were allocated responsibility to evaluate a project, but they didn't understand the business well enough or know who the right people were to talk to in order to do that effectively. [186]

This example further illustrates the limitations of traditional energy auditing approaches that focus on improvements on a site by site basis and in which both the range of opportunities identified and the quality of the financial data required to evaluate a project would be constrained through a lack of involvement from equipment and service providers.

In this case, the change came about by reflecting on prior experience with assessments and the development of a network of site-based energy champions. The outcome was that the boundary between equipment and service providers external to sites, as well as corporate groups within a site, had previously limited the scope of potential opportunities identified. It had also increased the time, effort and accuracy required to evaluate the cost/benefit associated with ideas once they were identified.

8.4.3 Identifying opportunities in real-time

A challenge for organisations that have been systematically focused on energy efficiency improvement is to continually improve. This is explained by the GM Sustainability in a commercial property organisation:

[186] Interviewee CQ Principal Energy Advisor Mining 2013

> " … in the first year or two, the rate of improvement is quite rapid and then it gets a little bit harder … we could see the rate of improvement beginning to slow around 2008 … I was wondering if we had maxed out … so we sort of put our heads to thinking ... is there a different approach because this approach seems to be running out of steam?"[187]

As the GM Sustainability explained, much of this initial improvement had been achieved through capital investment upgrades to the building, including replacement of chillers, upgrading building management systems and control systems, and installing new technology (e.g. more efficient lights). In order to better understand the factors that influence energy performance, he then decided to analyse two very similar buildings and compare their energy efficiency performance.

The buildings both had the same company as a tenant, were of similar age, with similar technology installed, and located within one block of each another. Despite these similarities, the extent to which the energy use per square metre had improved was around 50% in one building and around 20% in the other over the period October 2005 to October 2008. The organisation determined that the difference in performance was due to the skills and motivation of the person responsible for the day-to-day operation of the building. Based on this evidence, the respondent was able to justify investment in more sophisticated energy information tools. Training was provided to the facilities manager and other key members of each building's operational team. The improved information systems led to the establishment of daily benchmarks. That is, an email was sent to each of the building management team members every day showing their energy performance on the previous day and how this compared to optimal performance. The same email provided a target energy use for the day. Performance data was compared within a building and across the portfolio of buildings on a monthly and annual basis to compare the energy management performance of the building operations teams.[188]

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[187] Presenter BU GM Sustainability Commercial 2012

[188] Presenter BU GM Sustainability Commercial 2012

This example demonstrates how new potential opportunities to improve energy efficiency can result from continuous improvement and the development of new practices. This type of opportunity was unlikely to have been identified in the situation where an external consultant conducts an assessment and provides a report of potential opportunity areas, and it was developed following an energy efficiency improvement program that had been in place for a number of years. Even if an external consultant did identify the potential for such an improvement option, without detailed data it would be difficult for them to establish the potential savings and there would be many challenges to introducing accountability for energy use since this would involve changing the work practices of the building operations. For example, building operations teams could claim that they were too busy focusing on day-to-day operations and keeping tenants comfortable and safe in the building. Successful implementation required support from management as well as the operators in order to successfully implement the new regime. Thus, these multiple factors all contributed towards improving the identification and action taken on new opportunities in real-time.

Other property companies also reported that they were developing similar approaches.[189] The Energy and Sustainability Manager in one commercial organisation explained that they had linked continuous improvement to incentives:

> "Most people look out the window, they see a really hot day, they go: 'Fantastic, it's a lovely day'. Our people look out the window and start to think about what they need to do to reduce energy use in the building on that day so that they can work towards getting their bonus!"[190]

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[189] Presenter AN Director Consultancy Commercial 2011; Presenter AP Energy & Sustainability Manager Commercial 2011; Presenter BH Energy & Carbon Manager Commercial 2012; Presenter BL Manager Sustainability Commercial 2012; Presenter BT Sustainability Manager Commercial 2012

[190] Presenter AP Energy & Sustainability Manager Commercial 2011

8.4.4 Gaining support to implement projects

Ultimately, the success of improved energy management practices is demonstrated through the implementation of projects that deliver business benefits. Examining the process by which specific projects have been identified and implemented can provide insights into the influence that changes at the organisational and field level and how this impacts on energy performance. To better understand changing energy management practices associated with identifying and evaluating projects and the interactions between internal and external stakeholders, a project example is presented in Box 8.11, then discussed in more detail.

Box 8.11: Reducing the idle time on bulldozers

The EEO legislation requires diesel, electricity and other energy sources to be investigated. This example relates to an energy efficiency project implemented on bulldozers at a port operation. Bulldozers are an important part of port operations. Diesel is used primarily by bulldozers. Typical operating tasks include transporting and mixing coal around the site to support loading operations.

In this example, some new bulldozers had recently been purchased and, for the first time, they included fuel and activity monitoring. The data from the new bulldozers was reviewed and it showed that 30% of a bulldozer's operating time was spent idling.[191] Discussions with bulldozer operators highlighted that idling was caused by bottlenecks and plant breakdowns that occurred as coal was being loaded. These events often meant that bulldozers could not do useful work. As a consequence, the bulldozers would remain stationary with the engine idling for up to 60 minutes at a time. The reasons the bulldozers were left idling, rather than being turned off, included that the motor ran the air conditioner and the temperature in the cab would frequently be extremely hot. Some personnel involved in the workshop suggested other reasons. For example, some assumed that: "it is better for an engine to idle than to turn it on and off". A number of maintenance staff expressed the attitude of: "if it

[191] Meaning that the engine would be left running, but the machine would not be moving or doing any useful work.

isn't broken then don't change anything". This suggested that change was perceived as 'risky' because it can often lead to more significant and often unforeseen problems, so it is perceived to be better to maintain the status quo.

Following the workshop, further analysis was conducted. It was estimated that, on average, a bulldozer would idle for around 1,400 hours per year using 14,400 litres of fuel. As well as increasing fuel costs, the idle time was 'counted' as operating hours. Since maintenance schedules are based on operating hours, this significantly increased the maintenance requirement for the bulldozers over their lifetime.

The solution that was identified was to install an air conditioning systems for the cab that did not require the engine to be running in order for cooling to occur. Establishing the costs and benefits of the project was difficult initially because discussions with external suppliers had highlighted that there were no 'turn-key' solutions available. An open tender was used to identify suppliers who would be willing to jointly develop a solution.

A suitable supplier was identified and a trial was implemented. Following some major changes to the new design, the project established that a potential saving of more than AUD1m/year with a six month payback period was possible. After the successful trial the new technology was then applied to the other bulldozers.[192]

This provides an indicative example of how a new and innovative project can progress from idea to implementation. Key factors that contributed towards the success of the project at the field, organisational and project levels are set out in Table 8.3.

[192] Presenter AI Maintenance Superintendent Transport 2011

Table 8.3: Interactions between organisational and field contextual factors

Level	Success factors
Organisational field	• The site was seeking energy efficiency ideas, primarily as a result of the EEO legislation. • The original equipment manufacturer had recently incorporated improved fuel monitoring systems into their vehicles. • The supplier of the solution was willing to work collaboratively with the site to develop and trial the solution.
Organisation	• The assessment process involved representatives from across all functional areas in the organisation, which provided multiple perspectives on the risks and opportunities associated with the project. • Site management were willing to partner with an external provider to develop a new solution.
Project	• The availability of data enabled assumptions about operating practices to be challenged. • The trial provided further evidence of the cost-effectiveness and suitability of the solution. • Reduced maintenance costs as well as fuel savings were included in the cost benefit analysis.

The three different stages of the project (i.e. identification of the idea, evaluation of the idea and the decision) are set out in the paragraphs below.

At the first stage (i.e. identification of the idea), the availability of energy and operational data was crucial. The data exposed inefficient operating practices. By involving operational and maintenance staff at this point, their concerns and established assumptions could also be considered. This aimed to avoid potential barriers to evaluation and acceptance of the idea at later stages in the project's development. The level of internal negotiation and discussion with personnel was significant. The practitioners had existing positive relationships with a number of staff across the site. Such negotiation and engagement would have been difficult to achieve had the project been progressed by an external consultant.

In the second stage (i.e. evaluation of the idea), the support of the organisation and staff to trial a new idea were influential in its success. Also, since there was no turn-key solution available, collaboration between the organisation and its supplier was essential. The supplier was willing to adopt a level of risk in the project because they could see the benefits beyond this particular organisation; that is, they had highlighted innovation in energy efficiency as an issue for which other customers would require solutions. Incorporating maintenance benefits into the business case proposal made a significant contribution to the financial return associated with the business case proposal. Had the project simply focused on energy savings alone, the financial return would not have been as positive. Thus, the practice of incorporating wider business benefits into the evaluation was an important contributing factor.

In the third stage (i.e. the decision), the trial helped to establish the business case *and* build support for the project with operational and maintenance personnel. This led to wider application of the project within the organisation. The project has since been promoted more widely by the corporate energy practitioner at conferences and in the organisation's public reports. The supplier has also marketed their solution to other organisations – increasing the likelihood that energy savings will occur more widely.

This example further reinforces that identifying and evaluating energy efficiency projects requires the appropriate data and an effective process. An important part of the process is the development of business case proposals.

In 2010, the Department of RET commissioned research that aimed to better understand what successful energy efficiency practitioners do to improve the likelihood that business case proposals for energy efficiency projects will be successful. The project included the development of 18 project-level case studies from across the mining, transport, manufacturing, commercial buildings and services sectors. Each of the brief case studies described the process that was followed to identify and evaluate energy efficiency projects. The case studies and guidance material are available at: www.eex.gov.au.

Six key success strategies were identified across the different case studies. An important finding from the research was that rigorous financial evaluation of energy efficiency projects is essential, but not necessarily sufficient to support investment in energy efficiency projects. Successful business projects typically involved the final decision-makers in the process well before a final proposal was presented. Other important strategies included linking a project with current business priorities, involving a range of people throughout the process, identifying and showing how project risks would be managed and presenting a range of funding options. The rationale behind each of these strategies is summarised in Table 8.4.

Table 8.4: Six key strategies to improve the success rate of business case proposals

Strategy	Rationale
1. Link your project to current business priorities	Place the project within the wider business context by linking it to existing business priorities. This is likely to be more appealing to decision-makers.
2. Involve the right people in developing the business case proposal	Increase the credibility of the business case proposal by demonstrating that people with the appropriate expertise and influence have provided input.
3. Communicate with decision-makers early and regularly	Build awareness and obtain input from decision-makers to ensure the business case proposal is appropriately targeted.
4. Identify project risks and develop strategies to manage them	Demonstrate that risks have been carefully considered and will be managed if the project is implemented.
5. Describe and quantify all business costs and benefits	Demonstrate that the business case proposal is comprehensive.
6. Consider a range of funding options	Investigate the full range of funding options, both internally and externally, and leverage these where possible.

(Source: Crittenden & Lewis 2012, p. 5)

The Business Case and Beyond Project (see www.eex.gov.au/energy-management/the-business-case-and-beyond/) also highlighted how important it is to create a broader workplace culture of energy efficiency improvement. Some of the strategies proposed by practitioners to do this included ensuring that successful projects were monitored, verified and communicated widely. This helped to remind managers and staff across the firm of the business benefits associated with energy efficiency improvement. Regular senior management briefings were also considered essential. The regular briefings not only provide an opportunity to update management on successes, but these also provide a mechanism to communicate key challenges, additional resource requirements and any relevant changes external to the firm, including new legislation or government funding programs. Finally, those involved in the research encouraged other energy efficiency practitioners to review and challenge existing project approval processes. They suggested that it is easy to assume that current ways of doing things are fixed and cannot be influenced. However, many had found ways of modifying internal approval processes to support progress on energy efficiency by establishing energy efficiency funds or by bundling projects together in ways that presented projects as more attractive to decision-makers in the business.

8.4.5 Section summary

This section of the case research has described the energy management practices that organisations involved in the research applied to improve the identification and evaluation of energy efficiency projects. Key practices included:

- improving the way in which energy efficiency assessments were conducted – by adapting the approach from one assessment to the next and involving the appropriate people in the audit, including suppliers
- reviewing energy data on a day-to-day basis to identify and act on energy efficiency improvement projects in real-time, and
- improving the process by which business case proposals were developed.

Improvements were supported by the design of the EEO legislation. Organisations were encouraged to schedule site audits over a five-year period, rather than doing them all at the same time. This encouraged organisations to review and further develop their approach to identifying opportunities.

The case study material also demonstrates how organisations, through the involvement of government, can share their experiences about how to improve energy efficiency (in this case, through improving the way in which business case proposals were developed and presented to management).

8.5 Theme 4 – Integrating energy management within existing systems

8.5.1 Introduction

As corporate energy practitioners were working to broaden organisational involvement in energy management, improve energy information systems and improve the way in which new opportunities were identified, they were also establishing systems and processes that aimed to integrate energy management as a standard and ongoing business practice. The objective was to address the limitations of the piecemeal/episodic approach to energy management (a characteristic of traditional energy management approaches) to more effectively identify, evaluate and attract resources to implement energy efficiency projects.[193]

This section of the case research describes the key established management systems that respondents sought to integrate energy management into and how they went about it. The existing business systems and procedures examined in this section are:

- compliance management systems
- business improvement programs
- performance management systems, and
- operational procedures.

[193] Interviewee CM Climate Change & Resource Efficiency Manager Multi Sector 2013; Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Presenter AU Infrastructure Capability Manager Manufacturing 2011; Presenter BC Superintendent Energy Mining 2011; Presenter CA Environmental Manager Transport 2012

8.5.2 Compliance management systems

The EEO legislation required companies to undergo an externally-managed compliance audit at least once every five years.[194] Other legislation, such as the NGER Act, also required organisations to put in place a structured system to ensure that they could track and document their energy data and energy management activities.[195]

Respondents explained that the requirement to undergo external verification encouraged them to be more systematic in their approach and to document their activities more carefully.[196] Initially, however, the effort required to establish separate compliance management systems for energy-related legislation was found to be significant. This encouraged corporate energy practitioners to identify ways to better use existing compliance management systems. This situation is explained by the Principal Energy Efficiency in a large manufacturing organisation:

> "As we put systems in place to meet our compliance obligations, we began to find ways of modifying them to match our internal needs. Compliance was the basis for putting them together, but since then, we have modified them even further to better support our business."[197]

Large organisations typically have formal systems and procedures that they use to review and check that the organisations compliance obligations are being met. Many of these systems are based on the Plan-Do-Check-Act cycle that has been popularised through the application of formal quality, environment and safety management systems.[198] The approach taken to integrating compliance management systems with energy management at a

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[194] RET 2010, 'Verification Handbook'.

[195] Presenter BK Strategic Projects Manager Mining 2012; Presenter BO Energy Analyst Manufacturing 2012; Presenter BZ Environmental Systems Manager Manufacturing 2012

[196] Presenter AY Senior Consultant Manufacturing 2011; Presenter CG Manager Sustainability & Energy Manufacturing 2012; Presenter CH Manager Environment & Sustainability Mining 2012

[197] Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013

[198] Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Presenter BH Energy & Carbon Manager Commercial 2012; Presenter BV Manager Resource Efficiency & Climate Change Manufacturing 2012

large manufacturing organisation is described in Box 8.12.

Box 8.12: Integrating energy management with compliance systems

A manufacturing organisation found that managing the compliance components of the EEO legislation was time-consuming and difficult to enforce within the organisation. To address this challenge, the organisation developed an energy assessment tool. The tool listed a series of focus areas to be assessed. This included central operational plant and equipment as well as ancillary services (e.g. compressed air).

The assessment tool includes checklists of all items that should be considered. For complex sites, the assessment of focus areas is spread out over a number of years. For less complex sites the assessment is spread out over a single year. These and other activities, such as monthly reporting, are scheduled into existing 'compliance calendars,' which list tasks, deadlines and the people responsible for ensuring that the tasks are fulfilled.

Environmental managers are required to report progress each month against tasks listed in the compliance calendars. Each year, a site is selected to be involved in an internal compliance audit. The compliance audit is undertaken by the Principal for Energy Efficiency in conjunction with the environmental management team. Personnel from other sites are also selected to be involved in the annual process. The compliance audit helps to identify the need for corrective actions, as well as sharing experience across the sites regarding the best way to implement the energy management components of the overall compliance management system.

The system is supported by monthly reporting to top line managers against established key performance indicators. This means that senior management are aware of progress against compliance and they also receive regular updates on the positive business outcomes associated with the energy management program. Non-compliances are also identified clearly and systematically, which means that the need for corrective actions can be identified early.[199]

This example highlights a number of advantages for corporate energy practitioners in using existing management systems. First, it allowed for existing infrastructure to be used. Compliance management systems have been developed over a number of years in many organisations and may be quite sophisticated in their design. Additional tools were required to incorporate energy management effectively, but a large part of the system was already well established.

Second, within organisations the use of these compliance management systems was already considered to be an established management practice. This helped to change the view of energy management as a separate activity that was not relevant to ongoing business operations.

Third, as an established system, senior management could have greater confidence that their compliance risk was being managed, and it provided a systematic feedback process that allowed for the early identification of potential non-compliance, rather than waiting for an external audit to highlight deficiencies. [200]

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[199] Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013

[200] Presenter BA Sustainability Manager Multi Sector 2011; Presenter BI Greenhouse & Energy Advisor Mining 2012; Presenter BR Energy Manager Utilities 2012

Respondents also explained that external compliance audits undertaken by the Department of RET provided a useful mechanism for obtaining feedback on and improving their approach to energy management.[201] The style and focus of the verification approach was reported by respondents to have helped create a constructive, rather than threatening, environment.

In the case of the EEO program, government representatives partner with external consultants with specific industry expertise to undertake the verification. The approach is explained by the Energy Project Engineer in a manufacturing organisation:

> "The people from the Department were flexible and very helpful. They were clear about what they're after and what they wanted the energy efficiency assessments to actually achieve. We did our own internal audit and saw that, for much of it, we had it covered. So I would encourage you to use the process to help you improve your approach to energy management."[202]

In summary, the requirement to undergo external audits provided an important motivation for organisations to document and track their energy management activities. Both internal and external verification audits provided important feedback on ways to improve. Initially, it was time-consuming and difficult for organisations to establish these systems – particularly where they were developed in parallel to existing compliance management systems. However, as organisations gained more experience with the compliance requirement they began to integrate their approach within existing compliance management systems, which enhanced the legitimacy of energy management within their organisations, provided useful feedback on performance and minimised the resources required to meet the legislative requirements.

[201] Interviewee CR Principal Energy Efficiency Engineer Manufacturing 2013; Presenter BJ Chief Engineer Manufacturing 2012; Presenter CB Technical Manager Manufacturing 2012

[202] Presenter AL Energy Project Engineer Manufacturing 2011

8.5.3 Business improvement programs

Energy management practitioners also looked to create opportunities to link energy management with other corporate initiatives. For example, in organisations with established business improvement systems using business improvement frameworks (e.g. 6 Sigma[203] and Lean Manufacturing[204]) there was an opportunity to use the expertise of the skilled personnel within such teams. In particular, these types of programs encourage the development of skills in analysing data, evaluating and tracking projects.[205] In some organisations it might be expected that energy would have already been a natural focus of such business improvement systems. However, as corporate energy practitioners explained, the focus on energy had traditionally been ad hoc and business improvement programs were typically focused on other business issues, such as increasing quality and throughput.[206] The Environment Manager Resource Efficiency & Climate Change in an energy-intensive manufacturing organisation explains:

> "In the second [five-year assessment] cycle we want to engage our people more and use our own internal resources to meet the requirements of the Act and to deliver the savings we're after. We've got an existing business improvement system that we've been using for a number of years, but in the past we have treated energy efficiency improvement as a separate process. Aside from requiring less resources, integrating the requirements of EEO within the existing business improvement system will help us to further engage all our workforce in energy

[203] 6 Sigma is a set of tools and strategies aimed at improving business processes. It was first developed at Motorola in 1985 and then became more widespread as General Electric applied the approach from 1995.

[204] Lean manufacturing is a production practice characterised by a focus on the creation of 'value' for a customer. This approach discourages waste of any kind, including that created through energy use. It consists of formal review and corrective action practices.

[205] Presenter AD Principal Greenhouse & Energy Manufacturing 2011

[206] Presenter AB Chief Engineer Manufacturing 2011; Presenter BI Greenhouse & Energy Advisor Mining 2012; Presenter BV Manager Resource Efficiency & Climate Change Manufacturing 2012

management."[207]

In order to involve business improvement personnel in energy management there needed to be a negotiation within their groups and an agreement to identify and evaluate projects in ways that would align with the compliance requirements of the EEO legislation, as well as to focus on the business improvement outcomes that they aimed to achieve. One benefit from this approach was that even though there had been an explicit focus on energy management for a period of time, often the energy perspective provided new and unique insights into other issues, such as productivity, throughput and reliability.

One project that offers an example of productivity benefits is provided by the Barrick Gold Corporation (*Barrick*) and described in a paper by Buckingham et al. (2011). *Barrick* had conducted energy audits in three of their operations in 2011. Energy efficiency benefits included up to a 20% net grinding energy reduction. As well as energy cost savings of around AUD5m per year, however, throughput had increased in the three operations by approximately 60,000 ounces of gold annually. Although the value of this additional throughput is not quantified in the paper, it is likely to be substantial – particularly as it occurred at a time when the price of gold was at an all-time high.

Since business improvement personnel were skilled in establishing productivity and other improvements, in many organisations they played an important role in identifying and quantifying business benefits beyond simple energy savings. This perspective contrasted with energy management consultants who were more likely to focus on the energy savings, rather than wider business benefits. However, the value of energy efficiency was not just in highlighting energy projects – it provided a new 'lens' or way of looking at the business, helping to identify and implement improvements in a range of ways including by improving throughput, reliability and maintenance regimes.

[207] Presenter BV Manager Resource Efficiency & Climate Change Manufacturing 2012

8.5.4 Performance management systems

Integrating accountability for energy management into formal employee performance management systems was seen by a number of the presenters as an important mechanism for change. The influence of this strategy is highlighted in the following quote made by a Project Manager for Energy Efficiency in a manufacturing organisation:

> "How do you get the people that have got a great deal of responsibility for production, and not a lot of spare time involved interested in energy management? We found a tool just recently and that's to do our own voluntary verification with all of the key managers in the same room together. Suddenly, it's not only one of their Key Performance Indicator (KPI), but it's a KPI they have to stand up and tell the Chief Executive about. Boy, that's powerful."[208]

Some organisations have been progressively incorporating energy efficiency performance into management and operational responsibilities. As a Manager for Energy and Greenhouse Gas in a mining organisation explained:

> "There's been a paradigm change with people on site. A lot of the initial resistors have left. So what's happened now is we get new people on site that understand that environmental management and also energy management is actually part of their job. So I find it a lot easier working with site energy champions now because when somebody starts, they understand from day one that it's actually part of their job. So I find now that they're holding me accountable, rather than the other way around. So there's been a paradigm change with energy champions on site."[209]

One of the companies that was able to do this successfully established direct links between energy efficiency performance and the remuneration bonuses for site and senior management. The Manager Greenhouse and Sustainability from a mining organisation explained that integrating energy efficiency into their performance

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[208] Presenter AV Project Manager Energy Efficiency Manufacturing 2011

[209] Presenter CE Energy Manager Mining 2012

management systems had taken a number of years and a high degree of consultation at both the site and corporate levels to achieve.

First, they had to review and develop new key performance indicators. The original performance indicator that was traditionally used to reflect energy efficiency improvement did not account for variations in energy performance that was beyond the control of management and staff. The new performance indicator was developed with experts, trialled on one of the sites that had the most positive culture for innovation and then rolled out across all of the sites.[210]

A number of other speakers explained that they were in the process of working through the same process.[211] A number saw significant challenges, but as their internal energy information systems were improving, and they were working in conjunction with their HR teams more often, they considered that they were likely to have some success in achieving such integration into their performance management systems.

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[210] Presenter AH Manager Greenhouse & Sustainability Mining 2011

[211] Presenter AU Infrastructure Capability Manager Manufacturing 2011; Presenter AW Group & Risk Sustainability Manager Multi Sector 2011; Presenter BX Environmental Programs Manager Transport 2012

8.5.5 Operational procedures

The energy efficiency assessments highlighted a number of operational and procedural changes that supported improved energy management. In contrast to large capital projects for which there is a clear phase of approval, implementation and commissioning, operational and procedural changes are less distinct in terms of when the project begins and how well the change is being implemented. There is also the risk that if a key operator leaves, then the knowledge would also be lost. One solution to this has been for new operational and procedural changes to be written in to standard procedures and incorporated into training programs.

> "We've written 31 energy efficiency procedures so far and they're always being improved. We have really got to document the things we do because if a key person leaves we've got to have the maturity and the robustness for this energy program to continue."[212]

For example, opportunities for improved energy efficiency were found in cases where operators used 'rules of thumb' to determine how much time major plant and equipment needed to 'warm up' prior to use or 'warm down' after use.[213] Opportunities for operators to share their perspectives on what was appropriate frequently revealed that there were a range of different opinions about the amount of time required. Investigation to clarify the requirements of the original equipment manufacturer helped to establish an informed guide to operation of the plant or equipment. Once established and trialled, the new procedure would then be incorporated into standard operating procedures and training, which would support ongoing performance. However, like any new practice, training, monitoring and feedback all played an important role in ensuring that the new procedures were effectively implemented.[214]

Although operational changes are typically seen as 'low hanging fruit' (a term often used to describe energy efficiency projects that do not require significant capital

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[212] Presenter AV Project Manager Energy Efficiency Manufacturing 2011

[213] Presenter AT Sustainability Analyst Manufacturing 2011; Presenter AU Infrastructure Capability Manager Manufacturing 2011

[214] Presenter AB Chief Engineer Manufacturing 2011; Presenter BE Product Manager Mining 2011

expenditure), many such changes were described by corporate energy practitioners as complex due to the range of different stakeholders that needed to be involved in the process from idea, to successful implementation and through to ongoing application of the new operating practice. Change also needed to be managed carefully; for example, in cases where external consultants or corporate personnel were involved there could be resistance from 'outsiders' telling personnel how to do their job.[215] The process also relied on the availability of sufficient data in order to determine the appropriate procedure. Original equipment manufacturers and suppliers typically needed to be involved to ensure that warranties would be appropriate to maintain the conditions of plant and equipment warranties.[216] HR professionals might then be involved in developing the new procedures in the appropriate format and supporting them through effective implementation, particularly where training was required.[217]

8.5.6 Section summary

This section of the case research has described a range of strategies that respondents have used to integrate energy management into existing business management systems. These systems include:

- compliance management systems
- business improvement programs
- performance management systems, and
- operational procedures.

The reasons for integrating energy management into existing systems included that:

- existing infrastructure could be used
- personnel were typically more familiar with existing systems
- using existing systems helped to more effectively show energy management as 'business as usual', rather than being perceived as separate from legitimate day-to-day management practices

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[215] Interviewee CL Principal Climate Change and Energy Efficiency Mining 2013; Presenter BG Senior Consultant Mining 2011

[216] Interviewee CQ Principal Energy Advisor Mining 2013; Presenter BG Senior Consultant Mining 2011; Presenter BX Environmental Programs Manager Transport 2012

[217] Presenter AH Manager Greenhouse & Sustainability Mining 2011

- the approach reduced the reliance on individual corporate and site-level energy practitioners, both in the short and long term, and
- integrating within existing systems helped to maintain ongoing focus and attention on energy management.

To make the changes, corporate energy practitioners had to work with other specialist personnel within the organisation (e.g. HR, business improvement specialists) and justify the reasons for the integration. Such integration also takes time and support. For example, performance management systems require good data and a measurement tool that managers and other staff consider to be credible.

8.6 Summary

The aim of this chapter has been to present the findings from the empirical research from the perspective of the key energy management practices that changed over the study period. It is highlighted that the changes in energy management practices were relatively consistent across the organisations involved in the study. These changes have been described in four key thematic areas that emerged from the analysis:

- engaging staff in energy management
- developing energy information systems
- identifying potential projects, and
- integrating energy management into existing management systems.

Within each of the thematic areas, new practices were described together with a description of the reasons for and process of change. These outcomes are summarised in Table 8.5 following.

Table 8.5: Changes in energy management practices

From …	To …
1. Engaging staff in energy management	
The external consultants lead energy management with the aim of establishing a list of costed energy efficiency projects. There is limited involvement and engagement with internal personnel.	Energy efficiency is linked to a range of business benefits in order to engage with and involve a wide range of personnel across organisational and professional boundaries.
2. Developing energy information systems	
Limited data available Low accuracy Information is not in a form that is easy to interpret It is difficult to justify further investment	Energy information systems are progressively developed by communicating achievements to justify additional investment over time. Improvements 'piggyback' on the introduction of new equipment, technology and other systems.
3. Identifying potential projects	
Energy efficiency opportunities identified through energy audits conducted every 3-5 years.	Energy efficiency is integrated into daily operational procedures and ongoing processes that support the identification of energy efficiency projects. Key decision-makers and other relevant stakeholders are involved and informed throughout the process of developing business case proposals for energy efficiency projects.
4. Integrating energy management into existing management systems	
Energy management is approached as an isolated activity in which the outputs from energy audits and other activities are made available to technical/ engineering functions of an organisation.	Energy management is integrated with business systems to support an ongoing focus on energy management. Systems include: compliance management systems; business improvement programs; performance management systems, and, operational procedures.

9. The dynamics of institutional change

9.1 Introduction

How and *why* do energy management practices change? This chapter brings together the analysis and observations from the empirical research to answer this important question and consider the implications for institutional theory and energy efficiency policy. It does this by drawing on the case research developed in the previous two chapters.

Chapter 7 presented important context that helps to explain changes in large Australian energy consuming organisations between the years 2006–2012. The chapter examined the institutionalised practices (i.e. the established practices that were accepted as the appropriate 'way of doing energy management' at the time) that were applied by organisations once the EEO legislation commenced, before analysing changes in the organisational field associated with energy management practices over the study period.

Chapter 8 then analysed the changes in energy management practices in large energy consuming organisations. The analysis exposed the reasons behind why such changes were made, the challenges associated with implementing new practices and the social dynamics of institutional change, including the strategies applied by corporate energy practitioners and other stakeholders to influence the change process at the project, organisational and organisational field levels.

This chapter proceeds in the following way. First the dynamics of changing energy management practices are explored within and across the organisational field, organisational and project levels of analysis. The implications for institutional theory are then discussed before examining the implications of the research for policymakers and practitioners concerned with accelerating the adoption of effective energy management practices. The chapter then presents the limitations of the research and recommendations for future research that will contribute new knowledge about institutional change, the energy efficiency gap and the process by which organisations adopt more effective energy management practices.

9.2 The dynamics of change within and across each level of analysis

9.2.1 Introduction

This thesis has examined the disruption, development and maintenance of corporate energy management practices in the context of project, organisational and organisational field-level dynamics. It developed a multi-level process model of institutional change and applied the model to the case of changing energy management practices within large energy-using organisations in Australia between the years 2006–2012. The empirical research has exposed critical links between:

- emerging stakeholders in the organisational field
  driving energy efficiency concerns
- the changing energy management practices adopted by large energy consuming organisations, and
- the shifts in underlying beliefs that inform the evolution of energy management practices across the institutional lifecycle from the disruption of new practices through the development and maintenance of new practices.

The research findings are summarised in Figure 9.1.[218] The next section expands on Figure 9.1 by summarising the process of change observed within and across each level of analysis.

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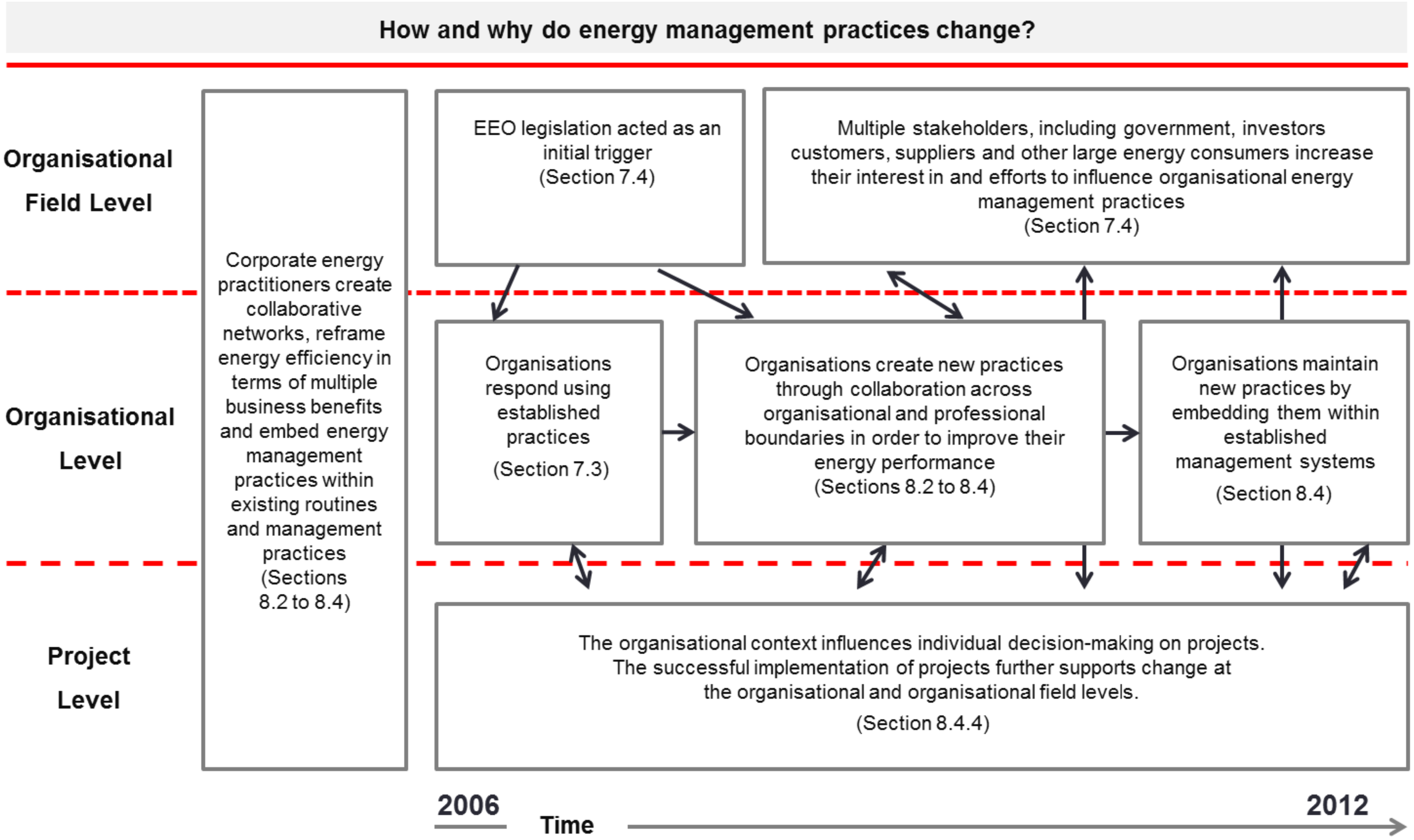
[218] A full explanation of the model and the origin of the research questions is provided in Section 5.8.

Figure 9.1: Three-level institutional change model applied to changing energy management practices



9.2.2 Changing energy management practices at the organisational field level

The EEO legislation acted as an initial trigger for organisations to review and modify their energy management practices. However, the EEO legislation itself did not act in isolation of a number of other important influences. While organisations were involved in conducting energy efficiency assessments as part of the first five year cycle of the EEO legislation, the organisational field associated with energy management was experiencing a period of dynamic change. New stakeholders were entering the field and the level of interest and influence of existing stakeholders was expanding.

The changing interests and influence of key stakeholders including government, investors and customers enhanced the importance of energy management within and external to organisations. This had the combined effect of influencing stakeholder perceptions of the value of energy efficiency.

Figure 9.2 portrays the interactions between stakeholders in the organisational field.

Figure 9.2: Interactions influencing new perspectives on the value of energy management

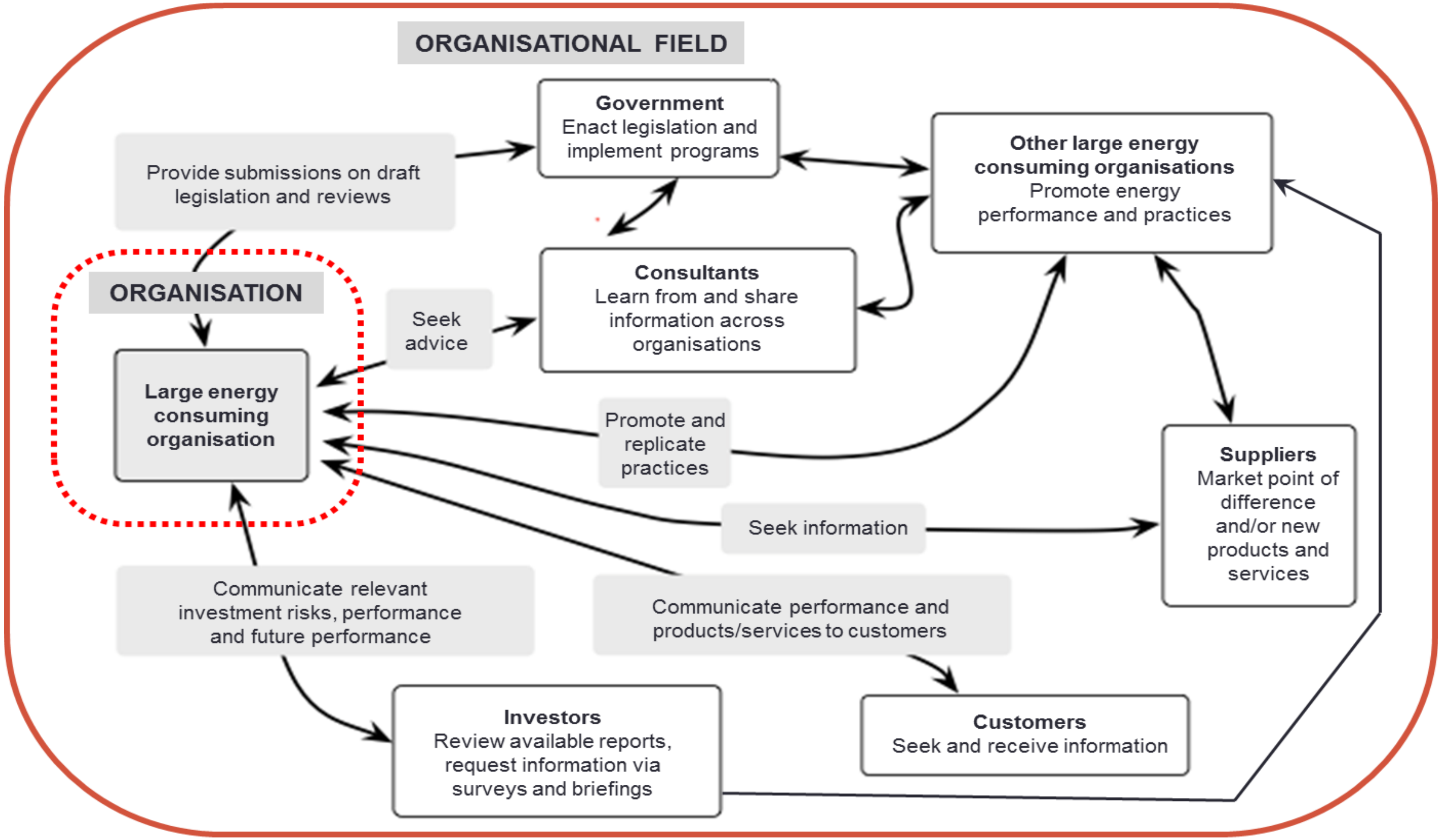


Table 9.1 outlines the research questions that were examined at the interorganisational level and provides examples against each key question.

Table 9.1: Examples of research findings – organisational field level

Research questions	Summary response
What are the triggers for change?	The EEO legislation acted as a trigger. However, its influence towards changing energy management practices was significantly reinforced through the emerging interests and influence of other organisational field constituents.
Who are the key organisational stakeholders that have an interest in energy management practices?	Key stakeholders include: • Government (multiple agencies) • Investors • Customers • Large energy consuming organisations • Suppliers
How do the organisational stakeholders interact and influence the development and adoption of energy management practices?	Examples include interactions between stakeholders through: • the development and review of legislation and programs • public reporting • interactions at conferences • investor briefings, and • competitive tendering.

From an activity that had previously been defined primarily as an energy cost-savings initiative, the emergence of new stakeholders broadened the perceived value of energy efficiency within large energy consuming organisations. Energy efficiency became more widely recognised as a means to manage compliance risk, enhance reputation, attract and retain new customers and support business growth through the development of new products and services. The relevance of these multiple benefits associated with energy efficiency varied from one stakeholder to another depending on their particular interests. The emergence of this diverse set of business benefits helped corporate energy practitioners and other stakeholders to more effectively promote energy efficiency within their organisations. By adapting their message to align with the varied interests of different internal and external stakeholders, corporate energy practitioners were able to more effectively build support and access resources to progress energy efficiency.

Changes in the organisational field did not occur in isolation from the influence of large energy consuming organisations. Through the work of corporate energy practitioners (in particular), organisations attempted to influence the perspective of external stakeholders in a number of ways. For example, government policy and legislation was influenced through formal consultation mechanisms that were established around the release of white papers, draft legislation and program trial processes. Corporate energy practitioners were also active in promoting their achievements through government-sponsored conferences and written case studies.

By adopting a leadership role and promoting their achievements, corporate energy practitioners helped shape the wider industry perspectives on the appropriate practices that were associated with energy management. At the same time, they created legitimacy for such practices within their own organisations. Large energy consuming organisations also interacted with investors and customers to inform them of the importance of energy management and the actions that their organisations were taking.

Investor and customer interests in energy management were influenced by the increasing volume and progressive introduction of government legislation, including the EEO legislation, NGER Act and the *Clean Energy Act 2011* (Cth). Their interest was further reinforced by rising energy prices. Investors sought information from organisations through surveys and briefings, and by reviewing the growing availability of energy-related information reported by large energy consumers. By responding to investor surveys and briefing investors, large energy consuming organisations were able to promote their own energy performance, which placed pressure on their competitors to improve their energy performance.

Specific elements of the EEO legislation also had important influences. For example, requirements to undertake detailed data and analysis highlighted new opportunities, presentations by leading practitioners at annual conferences highlight what is possible and how challenges could be overcome and formal verification processes meant that organisations were held accountable to meeting the requirements of the legislation.

Corporate energy practitioners also influenced customers by:

- actively promoting their energy management approaches in industry for a
- emphasising their energy performance and energy management capability when responding to competitive tenders, and
- developing new products – often in collaboration with customers and other stakeholders, such as equipment suppliers.

9.2.3 Changing energy management practices at the organisational level

The research found that organisations initially responded to the EEO legislation in a way that reflected previously institutionalised energy management practices; that is, they used an external consultant to conduct an energy efficiency assessment and attempted to limit the involvement of internal personnel. When the EEO legislation was introduced in 2006, there was relatively little interest from other stakeholders in the organisational field regarding the energy efficiency performance of organisations.

As the relevance of energy management increased through interactions between large energy consuming organisations and other stakeholders, corporate energy practitioners were able to justify and access greater management support and resources for energy management. With greater legitimacy for energy management, new practices emerged. These allowed organisations to better identify improvement opportunities and obtain support from key decision-makers for the implementation of these opportunities. The key areas in which new practices emerged included those associated with:

- engaging staff in energy management
- developing energy information systems

- identifying potential projects, and
- integrating energy management within existing business management systems.

While these practices themselves are not surprising (they are widely acknowledged within the existing energy management and broader organisational change literature), it is the dynamics associated with the *way* in which the practices were developed and maintained that offers important insights into the process of institutional change.

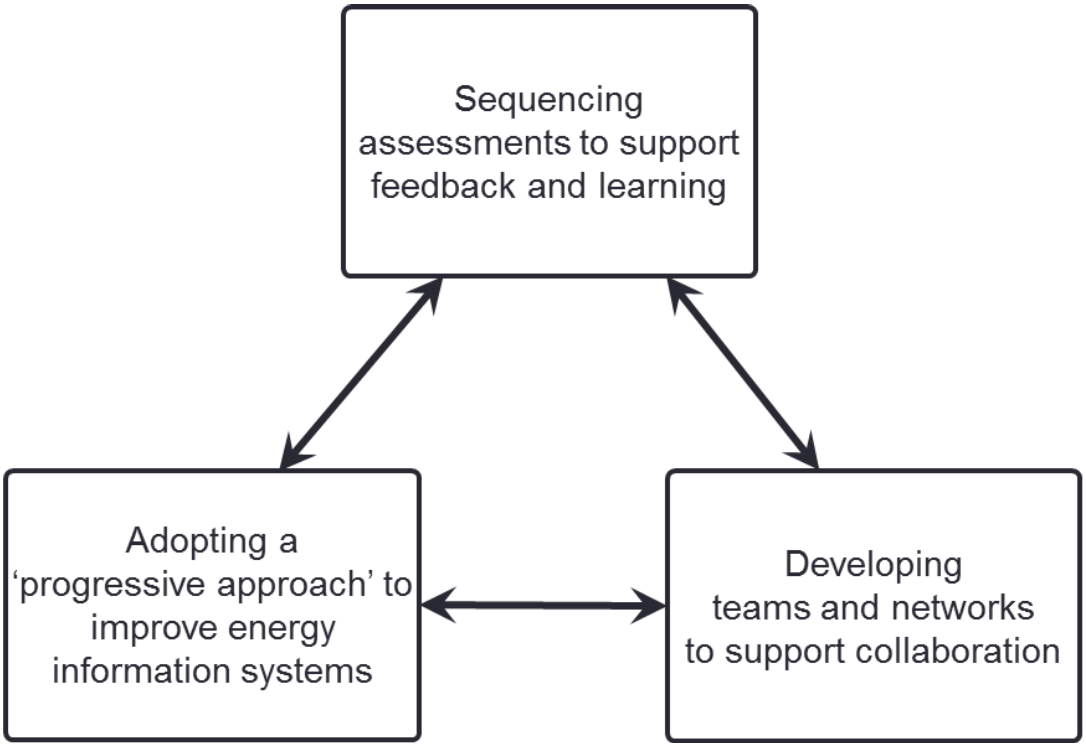
New practices were typically developed in a highly collaborative way. Corporate energy practitioners encouraged collaboration by:

- reframing the benefits of energy management (to obtain the interest of relevant internal stakeholders)
- involving personnel in the development and trialling of new practices, and
- promoting successful outcomes.

Three key mechanisms supporting the process of change included:

1. sequencing assessments to support feedback and learning
2. developing teams and networks to support collaboration, and
3. communicating results to obtain additional resources (see Figure 9.3). These mechanisms are discussed in the following paragraphs.

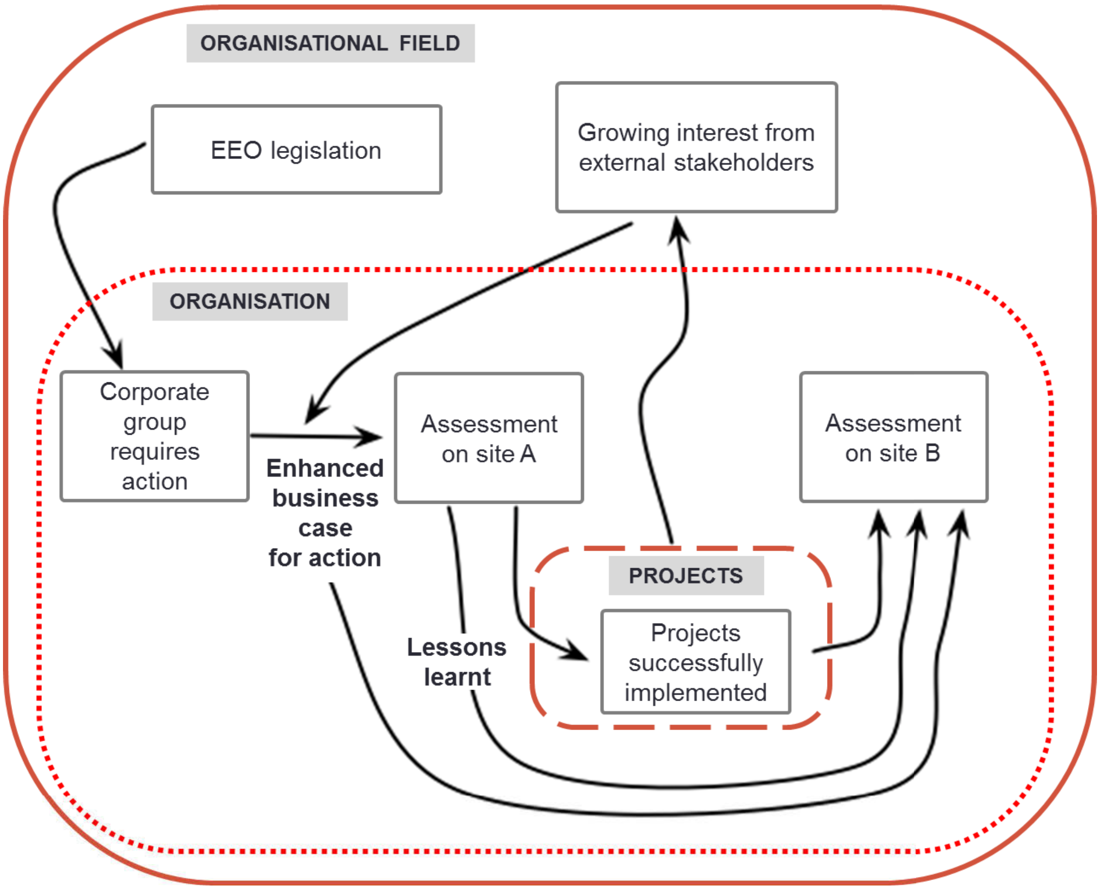
Figure 9.3: Strategies that support change in relation to energy management practices



Strategy 1 – Sequencing assessments to support feedback and learning

Learning and continuous improvement in energy management practices was supported by the sequencing of energy efficiency assessments. Figure 9.4 illustrates the dynamics of this process. The diagram suggests that the EEO legislation provided an influential trigger for action – particularly as the liability was highlighted at the most senior levels of organisations. As corporate groups became involved in planning the organisational response, first assessments were conducted at the site level (Site A). The results from the assessment were communicated within the organisation and to external stakeholders through the annual public reporting mechanism (a requirement of the EEO legislation). These results demonstrated to the organisation's stakeholders that beneficial outcomes were possible and improved the extent to which stakeholders were able to compare the performance of one organisation with another. Together with other events in the organisational field (e.g. the potential introduction of a carbon pricing scheme), the drivers for energy efficiency improvement increased. This, in turn, enhanced the business case for energy efficiency, which was typically clearer and more convincing by the time subsequent assessments (e.g. at site B) were undertaken. Experience from conducting an initial assessment could be reviewed to improve the manner in which an assessment was undertaken in subsequent assessments. By the time of subsequent assessments the business case for energy efficiency was enhanced through the implementation of successful projects, as well as the growing interest and influence of external stakeholders. The legislative requirements encouraged firms to sequence the assessments over a period of time and to report on the outcomes of assessments on an annual basis. This contributed towards the development of a structured and sequential learning approach in the majority of the organisations involved in this study.

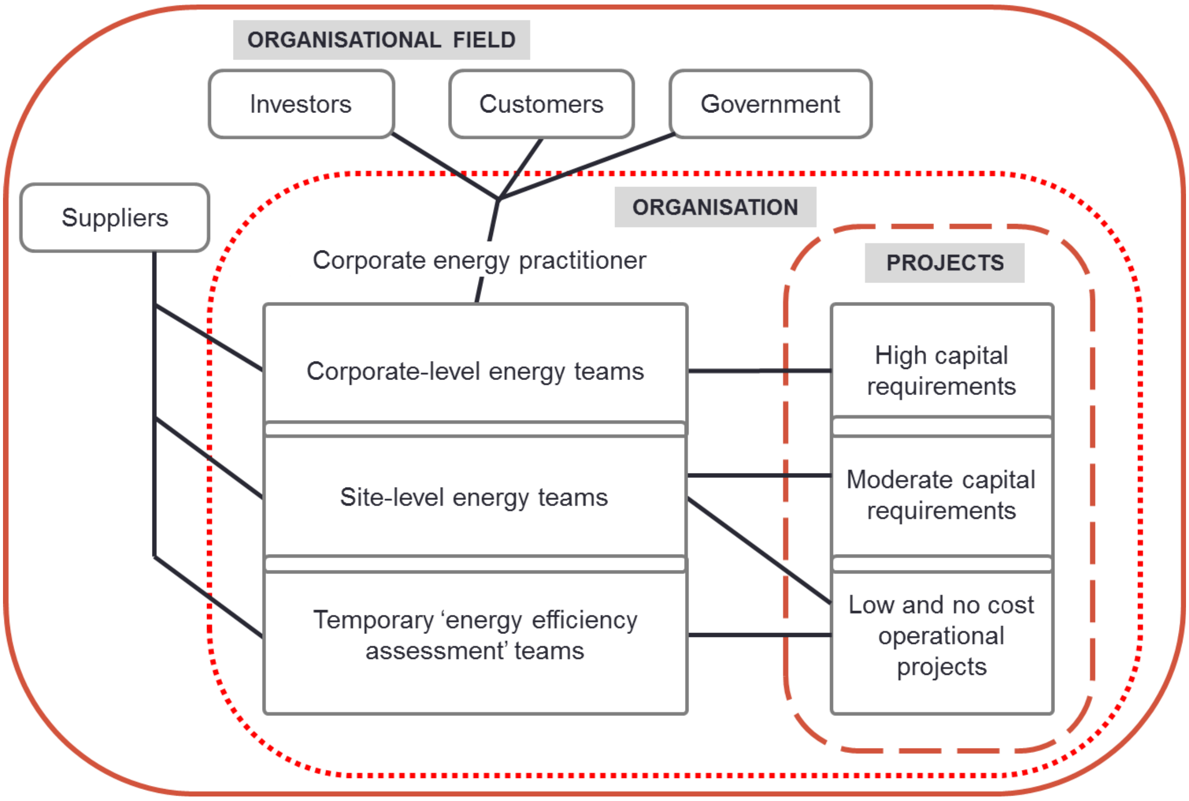
Figure 9.4: Learning from one site assessment to the next



Strategy 2 – Developing teams and networks to support collaboration

Figure 9.5 illustrates the manner in which teams at different levels were used by organisations as a mechanism to broaden accountability and to progress energy efficiency improvement. Teams also provided an opportunity to widen communication of developments in the organisational field with personnel representing different functional and professional areas within an organisation at both the corporate and site levels. Teams at different levels played different roles in the change process and were responsible for progressing the implementation of different types of projects. This presents a more sophisticated view of the use of teams across an organisation than is typically represented in the academic literature.

Figure 9.5: Relationship between types of projects, teams and external stakeholders



Corporate-level teams provide an important conduit for sharing information gleaned from external organisational stakeholders, including government, investors and customers, and sharing that information back into the organisations. This team level was also typically involved in projects requiring a high level of capital investment. Sitting across the whole organisation (in terms of both business units and functional disciplines) meant that this team and the corporate energy practitioner played an important role in sharing the experience and learnings gleaned from site-level teams.

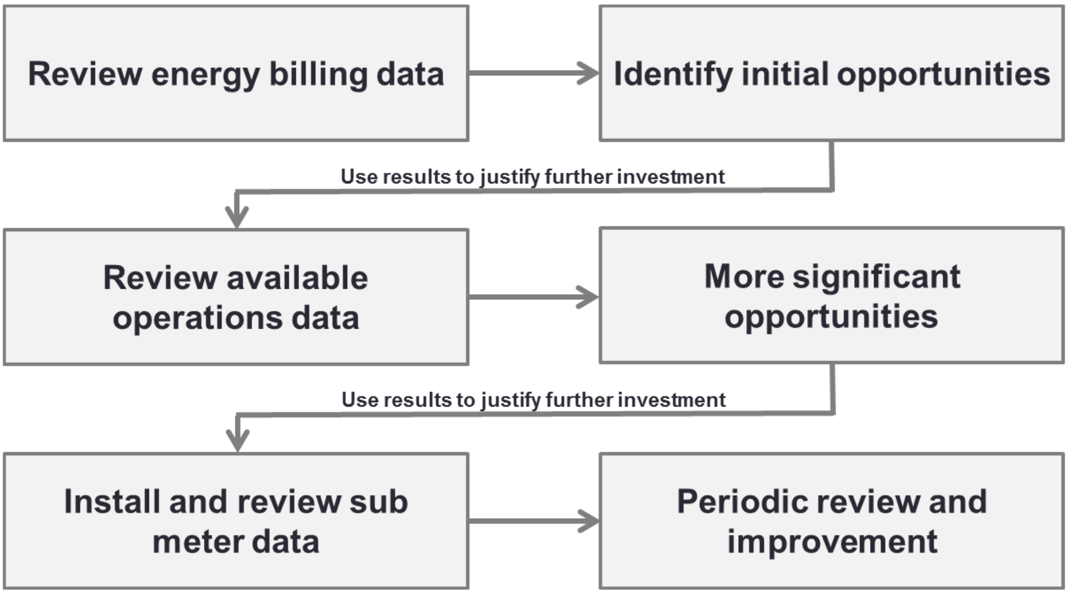
Site-level teams were less concerned with stakeholders external to the organisation as their targets and performance were typically set by senior management in the corporate office or from senior site-level management. Their interest and concern was generally associated with projects requiring moderate levels of capital investment (i.e. projects falling within their existing maintenance and operational budgets). Site-level teams also exhibited an interest in low and no cost operational projects – particularly projects that might have some level of impact on day-to-day operations. The site-level energy teams provided continuity and focus on energy management, including reviewing the outcomes of energy efficiency assessments, supporting ongoing evaluation of identified improvement options and tracking progress towards site and corporate-level energy targets and goals.

Temporary teams established to conduct energy efficiency assessments provided an opportunity for personnel to be involved in energy efficiency without the same level of ongoing commitment associated with site-level energy teams. Corporate energy practitioners found that effective interaction and collaboration across functional areas through this process could improve the quality of the energy efficiency improvement opportunities identified. It would also minimise the time spent on projects that were presented as ideas, but which were not feasible. For example, having a manager responsible for safety involved in the team could ensure that safety as a criterion could be considered from the start, rather than having a project be evaluated for costs and benefits, only to find (at the end of a comprehensive process) that there was a substantial safety issue meaning that a project like that could not proceed, even though it presented a positive financial return.

Strategy 3 – Adopting a 'progressive approach' to improving energy information systems

The availability of sufficient, accurate and accessible energy data is fundamental to energy efficiency improvement. However, the challenge for organisations and the energy management practitioners responsible for progressing energy performance is that it was difficult to justify investment in improving energy information systems when the benefits were difficult to quantify. One important strategy applied within organisations to address this challenge and obtain other resources for energy management was to adopt a 'progressive approach' in which early results were used to justify further investment. This progressive approach is summarised in Figure 9.6. It involves using existing data to identify and implement opportunities. As energy efficiency projects are implemented, the results are then used to justify further investment. Further opportunities are implemented and, with the additional savings, more comprehensive investment of sub meter data is made. This is followed by continuous improvement through periodic reviews.

Figure 9.6: A progressive approach to improving energy information systems



This process highlights a number of important points about energy efficiency improvement and energy information systems. First, there have been few clear guidelines or agreements on the level of data that is required in operations to identify, evaluate and implement opportunities. This has been challenging because of the diversity of operations and the way in which energy is used within and across industries. Second, obtaining resources for improved metering has typically been very difficult for energy efficiency practitioners. As discussed above, one successful strategy has been to implement smaller projects and use the positive results from these projects to justify investment in more sophisticated data and monitoring systems. Once achieved, the savings from the early work have assisted in justifying investment in improved monitoring equipment.

Section summary –Changing energy management practices at the organisational level

Table 9.2 summarises the research findings at the organisational level

Table 9.2: Summary of research findings – organisational level

Research questions	Summary response
How did organisations respond initially to the trigger for change?	Typically, organisations used an external consultant to conduct the energy efficiency assessment with limited involvement by internal staff. This approach to energy management was seen to minimise disruption and address skills limitations within the organisation.
Who were the key stakeholders within the organisation?	Internal stakeholders were multiple and varied. They included senior management through to operational personnel and key functional areas, such as HR and IT.
What energy management practices changed?	Examples include: • a deeper analysis of energy use was relied on to identify and analyse improvement opportunities • there was greater involvement of personnel across functional and hierarchical boundaries • there was development in the area of business case proposals – these more comprehensively accounted for business benefits as well as energy savings • there was ongoing tracking and communication of the organisation's energy efficiency performance within and outside the organisation, and to external stakeholders. • there was continuous improvement, rather than a series of single episodic approaches through energy efficiency assessments
How and why did they change?	Change was facilitated by corporate energy practitioners, in collaboration with cross functional teams, improvements in energy information systems and sequencing of assessments. Interactions between stakeholders at multiple levels enhanced the rationale for the development and maintenance of more effective energy management practices.

Research questions	Summary response
What actions are taken to maintain the new practices?	To maintain the new practices, corporate energy practitioners have been integrating the practices within existing business systems, including establishing role descriptions and accountabilities for relevant staff across their organisations. Ongoing briefings to senior management has also played an important role in maintaining the support of senior management.

9.2.4 Project-level perspective

The research found that newly-developed energy management practices have supported the identification of energy efficiency improvement options that may have otherwise remained hidden. For example, improving the quality, reliability and ease of accessing energy data has enhanced the identification of low and no cost energy efficiency initiatives that can be achieved through changes in day-to-day operational protocols and practices. Another example is that by drawing on and involving internal personnel with specific and localised expertise, ideas for energy efficiency improvement can be more quickly evaluated and are more likely to be successful since appropriate personnel are more directly involved in the process. Decision-making on energy efficiency was enhanced by involving decision-makers early in the process, rather than presenting them with a business case proposal for a project that they were not previously informed of. The communication of improved energy efficiency performance by the organisation to organisational stakeholders further reinforced the importance and value of effective management practices. This, in turn, built credibility at senior levels of organisations which enabled corporate energy practitioners to obtain additional support and resources for energy management. A summary of the research questions and findings at the project level are summarised in Table 9.3.

Table 9.3: Summary of research findings – project level

Research questions	Summary response
How do the new practices influence the identification of energy efficiency projects?	Examples include: • improving the quality, reliability and ease of accessing energy data • drawing on/involving experienced internal personnel • modifying assessment processes to enhance the identification and evaluation of energy efficiency projects.
How does the organisational and field-level context influence identification, evaluation and decision-making on energy efficiency projects?	Examples include the following: • Legislation specifically requires energy efficiency assessments and evaluation. The interest of external stakeholders, such as investors and customers, further enhance the priority placed on energy efficiency improvement projects • Organisational commitments, such as targets, legitimise the focus on energy efficiency improvement as a business priority which, in turn, raises the expectation for projects to be successfully implemented in order to improve performance.
How do successful projects reinforce new practices and influence stakeholders in the field?	The communication of improved energy efficiency performance by the organisation to organisational stakeholders helps to reinforce the importance and value of effective management practices. This, in turn, has helped to build credibility at the senior levels of organisations, which has enabled corporate energy practitioners to obtain additional support and resources for energy management.

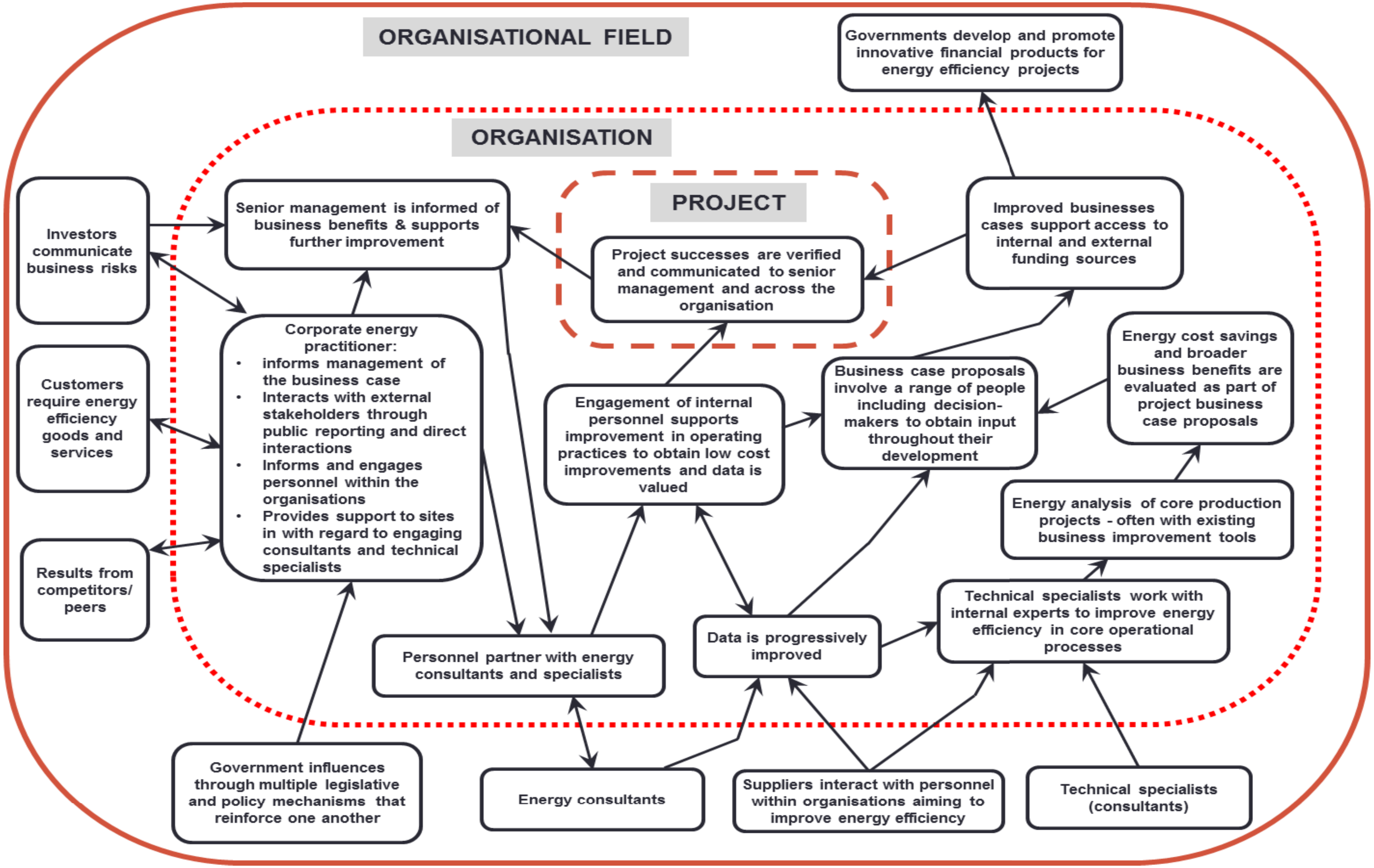
9.2.5 An integrated perspective: the dynamic process of institutional change

Figure 9.7 summarises the overarching dynamics of institutional change associated with energy management practices. The figure illustrates the linkages between project, organisational and organisational field-level interactions that have contributed to the evolution of energy management practices in large energy consuming organisations over the study period. The process shown in the diagram demonstrates how multiple stakeholders within and external to large energy consuming organisations interact to create the conditions that support positive feedback cycles. These positive feedback cycles support the development and maintenance of new and more effective energy management practices. Figure 9.7 contrasts with the process illustrated in Chapter 7 at Figure 7.4, which presented the limitations of the 'traditional' energy management practices that were typically applied by organisations in early energy efficiency assessments as they responded to the EEO legislation.

On commencement of the EEO legislation, there were relatively few external stakeholders who exhibited an interest and influence over energy management practices. The primary influence in the organisational field was the government department responsible for the EEO legislation and energy consultants. By the end of the study period, however, multiple stakeholders were more actively involved, including government departments, investors, customers, suppliers and technical specialists. Of note is the increased level of interaction between the stakeholders within organisations and those external to large energy consuming organisations. Also, the diagram highlights how the role of the corporate energy practitioner has typically expanded from a technical or energy audit project management role to one that involves interactions and communication between internal and external stakeholders.

Senior management support is developed as results are achieved by the organisation and as the interests of external stakeholders help corporate energy practitioners to reframe energy efficiency as a broader business issue, rather than simply promoting the cost-saving benefits. Communication programs, teams and direct engagement

Figure 9.7: Interactions within and across levels to support the adoption of energy management practices



within the organisation by the corporate energy practitioners helps to build support for energy efficiency. The involvement of internal personnel and the more focused use of external consultants, including technical specialists, enhances the number and scope of the energy efficiency projects identified. The process is supported by progressive improvement in the quality, accessibility and analysis of energy and production data.

The increased level of engagement between internal personnel, including those involved in decision-making, increases the quality and success of business case proposals. This increases the likelihood that projects will receive funding and support for implementation from both internal sources and government funding. Greater evidence of success and support from senior management justifies progressive improvement in energy efficiency information systems which, in turn, contribute towards the identification of new energy efficiency projects. The following section considers the theoretical implications of the research findings.

9.3 Implications for the paradox of embedded agency and institutional change

9.3.1 Introduction: A process of collaborative co-creation

As discussed in Chapter 5, as institutional theorists have increasingly examined institutional change as well as institutional stability, they have been challenged to explain the "paradox of embedded agency" (Dorado 2005; Holm 1995; Seo & Creed 2002). This paradox presents the theoretical question: how do actors effect change when their intentions, actions and rationality are conditioned by the very social structures that they seek to change? (Battilana, Leca & Boxenbaum 2009; Czarniawska 2009; Seo & Creed 2002).

DiMaggio's (1988) essay on 'Interest and agency in institutional theory' introduced the concept of institutional entrepreneurship and prompted research that examined strategy and power within institutional theory and shifted attention toward the way in which actors purposefully influence institutions (Lawrence & Suddaby 2006). However, a contemporary critique of the growing body of literature that has examined institutional entrepreneurship suggests that institutional entrepreneurs have typically been presented as powerless, at one extreme, or as overly powerful, at the other (Fligstein 2001; Powell & Colyvas 2008; Suddaby 2010b).

This thesis contributes new perspectives on the paradox of embedded agency and institutional change by examining the process of institutional change from the point of view of 'distributed agency'. That is, it has focused on the interactions between multiple stakeholders to examine how the dynamics of these interactions influence the way in which the institutions associated with energy management practices in organisations change over time. This approach addresses the call from scholars to conduct empirical research to better understand the implications of distributed agency for the process of institutional change (Battilana & D'Aunno 2009; Dorado 2005; Garud & Karnøe 2003; Hargrave & Van De Ven 2006; Lawrence, Suddaby & Leca 2011; Perkmann & Spicer 2008; Reay & Hinings 2005).

The research has revealed the diversity and influence that an eclectic set of stakeholders have had on energy management practices throughout the six-year period examined in this study. It has drawn on the perspective of corporate energy practitioners who have been well placed to share their perspectives as to who the most influential stakeholders are, how they influence change in energy management practices and the relative influence of different stakeholders at different times across the institutional lifecycle[219] associated with energy management practices.

The research demonstrates how social practices change through a process of collaborative co-creation, in which multiple organisations interact over time to disrupt previously institutionalised practices and to create new practices. This research has highlighted the role of Australia's first national energy efficiency legislation, the EEO legislation, as an influential trigger for change. However, the influence of the EEO legislation is intertwined with the entrance and growing influence of a number of other stakeholders into the organisational field associated with energy management practices. These stakeholders include other government agencies, investors and customers. The involvement and influence of new

[219] The institutional lifecycle describes change in institutions from their disruption through development and then maintenance as newly-established or institutionalised practices.

stakeholders emerged through a recursive process in which corporate energy practitioners played a central role in ‘translating’ the significance of these external drivers for change within their own organisations at the same time as they sought to influence the actions and intent of the very same stakeholders that they were being influenced by (Hoffman 2001; Zilber 2006) .

In Chapter 5, two contrasting views of institutional change were discussed. The first was a dialectical view. Here, loose coupling between individuals and organisations creates divergence and contradiction within interconnected systems which leads to conflict and ultimately creates resolution through praxis (Seo & Creed 2002). This view has informed the description of institutional change as ‘a battlefield’ in which institutional war is waged between powerful actors (DiMaggio 1988; Hoffman 1999; Reay & Hinings 2005). However, the process of institutional change that was observed in this case research was more in keeping with an alternative view of institutional change, which Zietsma and McKnight describe as “collaborative co-creation”; that is, multiple actors are involved in experimentation, negotiation and consensus processes. Their interactions inform the development of shared templates that incorporate the interests of multiple parties (Zietsma & McKnight 2009).

Collaborative co-creation processes have been observed at multiple levels and at different phases in the institutional lifecycle. For example, at the organisational level, corporate energy managers illustrate the importance of negotiation with internal stakeholders. This is particularly apparent at the beginning of the institutional lifecycle when practitioners attempt to disrupt previously established practices. Negotiation is essential since practitioners have limited coercive power and instead rely on aligning the diverse motivations of internal stakeholders with the activities and outcomes of energy management.

At the interorganisational level, the government department responsible for the EEO legislation attempted to work collaboratively with organisations throughout the development and implementation of the legislation. This resembles the process of co-creation that Zietsma & McKnight (Zietsma & McKnight 2009) observed in relation to forest management agreements. Common to both situations is that power is dispersed across many stakeholders, supporting negotiation to create shared interests, rather than contestation around fixed positions. A collaborative approach was reinforced as trust and knowledge developed between stakeholders. Early concerns within organisations about the coercive influence of the legislation softened as the strategic benefits and "innovation offsets" (Hoffman & Woody 2008; Porter & Reinhardt 2007) available to organisations began to emerge and become recognised.

At the project level, corporate energy practitioners found that collaboration improved the likelihood that they would access resources. For example, they found that involving decision-makers and other key internal stakeholders in the process of developing business case proposals for energy efficiency projects helped to build awareness and support for their projects. In part, this was because the involvement of multiple personnel helped to establish the multiple business benefits associated with a given energy efficiency project.

The research reveals four conditions that support successful institutional change through a process of collaborative co-creation. These conditions are that:

1. stakeholders with varying degrees of embeddedness are engaged in the change process
2. roles emerge for institutional entrepreneurs
3. collaboration is facilitated through the enactment of constructive social skills, and
4. change is underpinned by emerging shifts in institutional logic.

Each of these conditions are described in the following paragraphs.

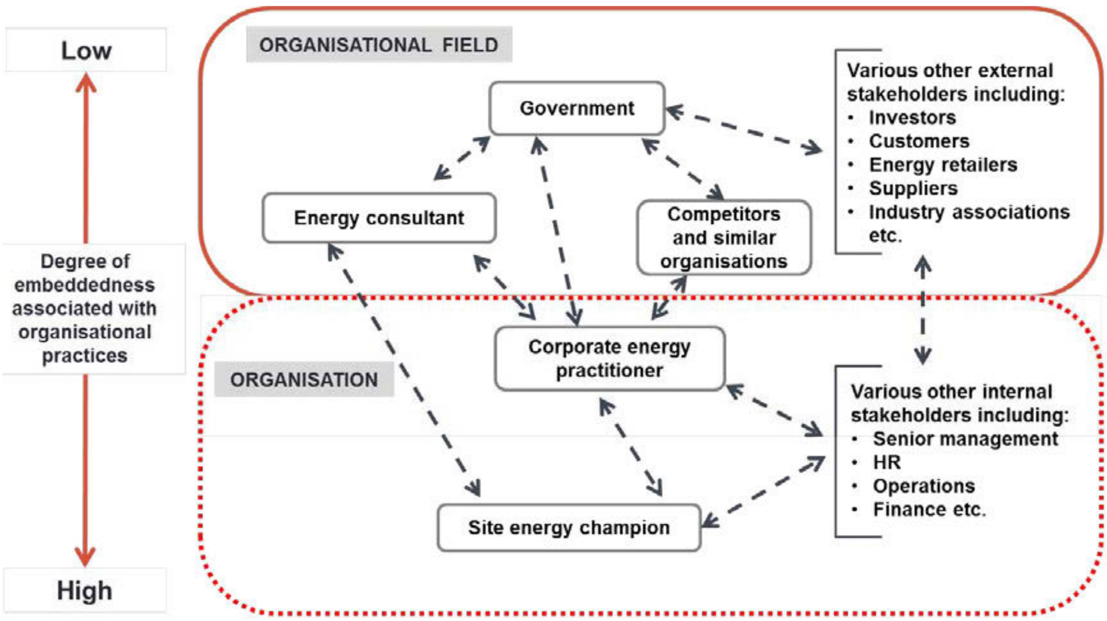
9.3.2 Condition 1 – Stakeholders with varying degrees of embeddedness are engaged in the change process

At the core of the paradox of embedded agency is the notion of 'embeddedness' which describes "the degree to which actors and their actions are linked to their social context" (Reay, Golden-Biddle & Germann 2006, p. 978). High degrees of embeddedness have traditionally been considered a constraint on institutional change (see Section 5.3). This is due to the expectation that highly embedded actors will be strongly influenced by the cognitive, normative and institutional mechanisms that act to maintain existing behaviours.

This perspective has been challenged by Reay, Golden-Biddle and Germann (2006). Their research examined the way in which experienced and highly embedded nurse practitioners challenged established patterns of work to introduce new work practices. The researchers found that the high degree of embeddedness of the nurse practitioners was advantageous in supporting change. The practitioners were able to use their inside knowledge to develop new and improved ways of working. Examining distributed agency and institutional change over time in this thesis provides further understanding of the relative benefits and limitations of embeddedness in relation to institutional change. Figure 9.8 illustrates the range of interactions between key stakeholders with reference to their degree of embeddedness within an organisation. To illustrate the relative benefits and limitations of embeddedness in relation to institutional change, the degree of embeddedness of three key roles associated with changing energy management practices are examined here. Those roles are:

1. energy consultants
2. corporate energy practitioners, and
3. site-based energy champions.

Figure 9.8: Interactions between stakeholders with varying degrees of embeddedness



Energy consultants can be expected to have the lowest degree of embeddedness of these three actors. That is, they are 'outsiders' to the organisations that they work with. On the one hand, this means that they can potentially bring new ideas and approaches to the organisation regarding energy efficiency. Many consultants have the advantage of having worked across a number of organisations and have direct experience of conducting energy efficiency assessments and progressing energy management. On the other hand, without appropriate support from within the organisation (e.g. appropriate energy information systems and access to people) their effectiveness has been shown to be limited. While the idea of handing over an energy efficiency assessment to an external consultant is appealing to the organisation and to policymakers since it can reduce the internal organisational resources required, this research suggests that over-reliance on external consultants is likely to limit the scope of energy efficiency measures identified, as well as the quality of the business case proposals developed. This suggests that potentially cost-effective energy efficiency measures may not even be identified and, those that are, may have a relatively poor likelihood of being adopted unless they represent clear financial benefits with little upfront investment and business risk.

It is difficult to ascertain the influence of different skills on the part of energy consultants from this research. However, there is some evidence that those that were most successful were able to partner with organisations over a longer period of time. This helped the consultants to become more embedded in the organisation through ongoing exposure and experience. That is, they progressively improved their understanding of business priorities, built links with the personnel who could influence project decisions and improved their ability to communicate the benefits of energy efficiency in a manner that was most appealing to particular internal stakeholders. Over time they also developed a successful track record which illustrated their contribution to the organisation. The research suggests that successful partnering between an organisation and a consultant may be a function of the:

- consultant's technical, communication and influencing skills
- strength of their relationship between the corporate energy practitioner and the organisation, and
- extent to which consultants are able to build effective relationships with

personnel within the organisation.

Corporate energy practitioners are more embedded in the organisation than energy consultants. Typically, they will have developed an understanding of the key priorities in the business and, by working in the organisation on a day-to-day basis, they have ongoing contact with staff across professional and functional boundaries. Through their position in the corporate group, corporate energy practitioners have access to senior corporate management in their organisation, which presents them with the opportunity to communicate the drivers for and benefits associated with energy management, which they use to obtain corporate support. Although corporate energy practitioners may have been considered 'insiders' from the perspective of the corporate groups in their organisations, they were typically perceived to be 'outsiders' in relation to operating sites where managers and operators are more directly involved in delivering the products and services that form the basis of the organisation's business. Since corporate energy practitioners were often introducing activities and requirements that require additional resources, they were (in the first instance) typically perceived to be constraining sites, rather than delivering value.

One important way in which this was addressed was by establishing site-based energy champions. That is, a role was established at the site level with responsibility for progressing energy efficiency improvements. Site-based energy champions are positioned much closer to day-to-day business operations. They are geographically advantaged by being located at sites and can develop relationships across the different groups and personnel at the site level. In many cases site-based energy champions also have the advantage of continuity, which allows them to better understand the culture of the site and build enduring relationships. However, recruiting appropriate personnel and minimising staff turnover remains a challenge for many organisations – particularly in sectors like mining which was experiencing a skills shortage at the time. Relative to corporate energy practitioners and energy consultants, they are highly embedded.

In a manner that is similar to the nurse practitioners described in the Reay, Golden-Biddle and Germann (2006) study, site-based energy champions have access to detailed knowledge of day-to-day operations. However, one of the factors that is likely to influence their effectiveness in introducing change is their high degree of embeddedness (i.e. being subject to the culture of the site, including the business priorities that are considered to be important, and the activities that are, accordingly, considered to be legitimate). Their link to the corporate office through the corporate energy practitioner was a factor that helped them to overcome this constraint. For example, the corporate energy practitioner could provide the site-based energy champions with tools, resources and project examples that would help them to more effectively promote the benefits of energy management at the site-level.

This brief perspective on roles highlights the strengths and constraints associated with the degree of embeddedness of each of these key stakeholders. Organisations that have successfully introduced new energy management practices have been able to exploit the strengths and limitations of each role and the relative degree of embeddedness by encouraging collaboration with internal and external stakeholders. This characteristic was not just observed within organisations across structural and professional boundaries, it was also observed in relationships between organisations and government departments and between large energy consuming organisations. Therefore, this research supports the finding from Reay, Golden-Biddle and Germann (2006) that stakeholders with high degrees of embeddedness have an important role to play in facilitating change. However, it goes further by illustrating the important need to involve a range of stakeholders with multiple degrees of embeddedness. However, the question then becomes, what conditions support collaboration between stakeholders with multiple degrees of embeddedness? A contributing factor is the emergence of roles for institutional entrepreneurs, such as corporate energy practitioners.

9.3.3 Condition 2 – Roles emerge for institutional entrepreneurs

Earlier in this thesis (see Section 5.3) institutional entrepreneurs were introduced as: "change agents who actively participate in the implementation of changes that diverge from existing institutions" (Battilana, Leca & Boxenbaum 2009, p. 70). This emphasis on 'divergence' as a defining characteristic of the institutional entrepreneur has been highlighted by many scholars (Battilana 2006; Greenwood & Hinings 1996; Greenwood, Suddaby & Hinings 2002; Schultz & Hinings 2012). To clarify, non-divergent changes are those which are aligned with existing institutions. For example, as the EEO legislation was introduced, many of the organisations replicated the accepted energy management practices of the time, which included contracting an energy consultant to conduct an assessment with limited engagement and involvement of internal personnel. This is an example of non-divergent change because although an organisation might have been conducting an energy efficiency assessment for the first time, the patterns of existing and well-established practice were replicated. Corporate energy practitioners exhibited a role as institutional entrepreneurs when they began to challenge the status quo by departing from practices that had previously been accepted as ‘the way to do energy management’, by introducing new practices. Thus, the corporate energy practitioners involved in this research may be considered to be institutional entrepreneurs since their actions clearly contributed towards divergent change, and they were actively involved in obtaining resources to support the change process.

What conditions encouraged the emergence of the corporate energy practitioner as institutional entrepreneur? As was highlighted in the beginning of the case study, the EEO legislation acted as an important trigger (i.e. a direct consequence of the introduction of the EEO legislation is that it encouraged organisations to establish a role with responsibility for ensuring that, as a minimum, compliance requirements were achieved). However, the expanding interest of other stakeholders, which led to the introduction of related legislation and growing interest on the part of investors and customers, for example, helped create an opportunity for corporate energy practitioners to challenge existing energy management practices. Further, the emerging interests of external stakeholders helped corporate energy practitioners to expand their role from one where they were responsible for compliance, to one which became responsible for briefing management on the implications of external changes. In addition, the role involved interacting with key external stakeholders (e.g. government, investors and customers) and, ultimately, improving energy performance and delivering value to the business through energy management. Table 9.4 lists some of the key activities that reflect the changing role of the corporate energy practitioner. The table illustrates how the role grew from an initial focus on legislation and compliance to one that encompasses advice, strategy, planning, the development of management systems, internal and external communications, staff engagement and reporting.

Table 9.4: Emerging role and activities of corporate energy practitioners

Activity	Aim
Legislation and compliance	Ensure that compliance requirements are understood and achieved by the organisation.
Advisory	Advise senior management and other relevant internal stakeholders on energy-related issues.
Strategy and planning	Develop a coherent plan for energy management and coordinate implementation across the organisation.
Management systems	Establish and maintain energy management systems.
Internal communication and staff engagement	Communicate the business case for energy management and motivate relevant internal stakeholders to support improved energy management.
External communications and reporting	Manage the development of public reports and liaise with key external stakeholders on energy management issues.

In playing an active communication and influencing role with external stakeholders, corporate energy practitioners also improved their access to senior management within their organisation. For many, an important part of their role was to communicate changes external to the organisation that could impact on their organisations. This presented corporate energy managers with an opportunity to continually reframe the benefits of energy management in a way that highlighted not only energy cost savings, but a range of other business risks and benefits as well, including legislative compliance, productivity improvements and competitive advantage.

Broadening the perspective of the value of energy management at senior management levels helped corporate energy practitioners to address what they perceived to be the limitations of the traditional energy management practices. In particular, it enabled them to broaden the scope of energy management beyond energy efficiency assessments conducted by external consultants and the idea that energy management was a ‘once every few years’ activity, rather than a continuous and integrated improvement process.

Changes in the organisational field also presented corporate energy practitioners with new opportunities and arguments to promote the benefits of energy efficiency within their own organisations. In part, this was due to the changing role of many corporate energy practitioners. These roles expanded from being predominantly legislation and compliance focused to roles where these practitioners were required to:

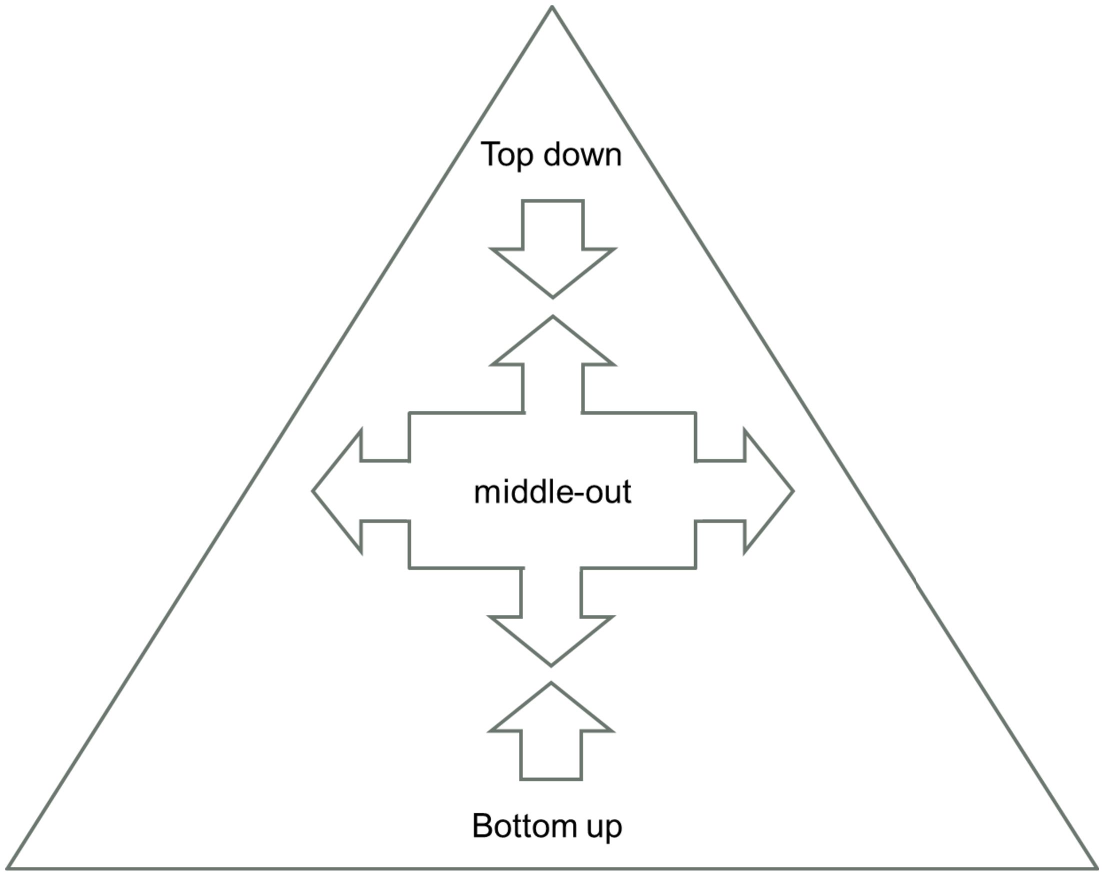
- advise senior management on energy and climate-related issues
- be involved in strategy and planning
- develop management systems
- support effective communication and engage staff.

Uncertainty in the external environment also facilitated access to senior management as organisations sought to understand the risks and opportunities associated with turbulent and ongoing changes in the external environment. Access was facilitated as management requested briefings on the changes, reviewed public submissions to be made on behalf of their organisations on proposed legislation and (in the case of the EEO legislation) senior management and boards were required to sign-off each year on public energy efficiency reports. Access to senior management helped energy practitioners to obtain the resources and support needed to bring about changes in energy management practices (discussed in the remainder of this case study). New practices included:

- broadening staff involvement in energy management
- increasing the visibility and relevance of energy efficiency to staff
- augmenting business systems (e.g. associated with the collection and analysis of energy data), and
- leveraging existing management practices to integrate energy management within existing business systems.

The actions of corporate energy practitioner resemble what Janda and Parag (2013)describe as 'middle-out' influence (Figure 9.9). That is, corporate energy practitioners exert influence 'upstream' to leverage the influence of senior management as well as external stakeholders such as government. At the same time they aim to influence 'downstream' by drawing on the influence of operational personnel and others within their organisations that are more directly involved in decisions and behaviour that effect energy use. They also influence sideways by influencing other corporate energy practitioners (e.g. through presentations at conference) as well as managers at a similar level but in other functional areas within their organisations.

Figure 9.9: Directions of influence
(Source: Janda & Parag 2013, p. 43)



How did these institutional entrepreneurs exert influence and facilitate change? The next section proposes three key social skills that were observed and which support the collaborative co-creation of new institutions associated with energy management practices.

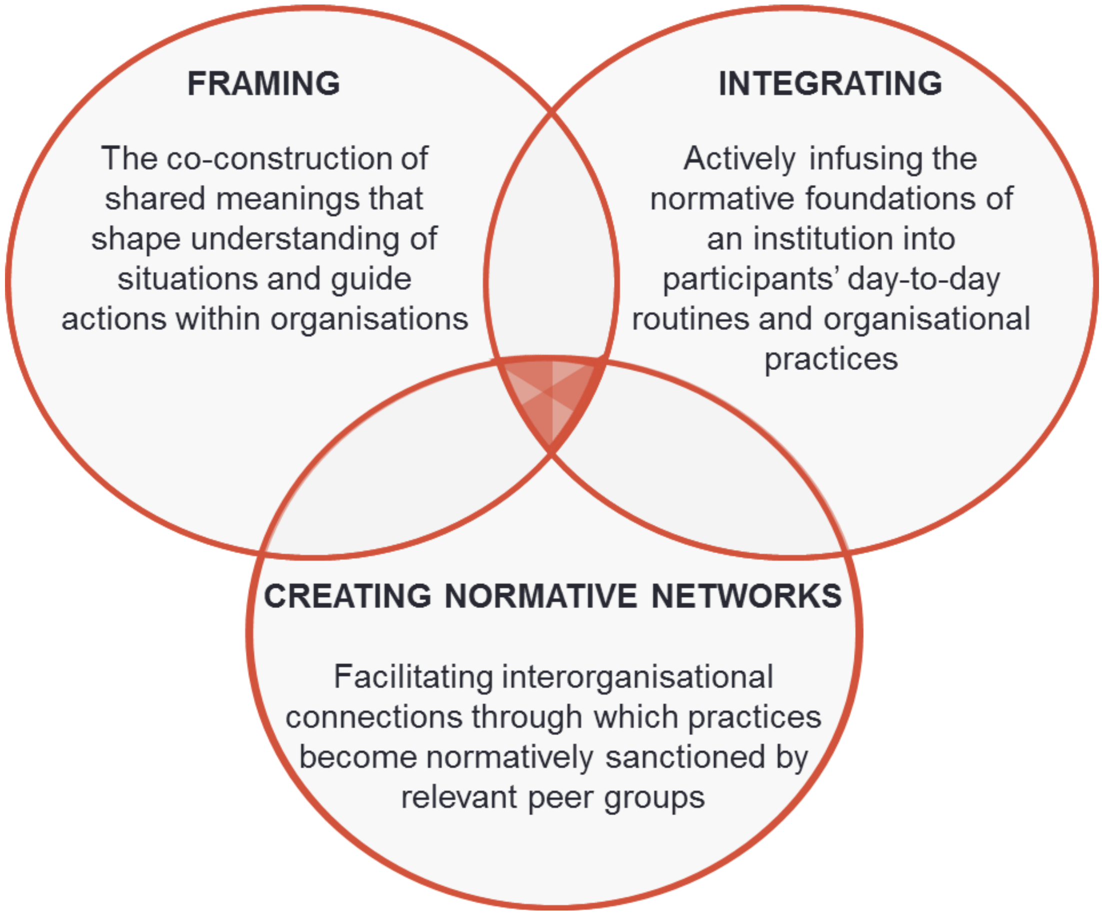
9.3.4 Condition 3 – Collaboration is facilitated through the enactment of constructive social skills

Social skills have been defined as “the ability to engage others in collective action” (Fligstein 2001, p. 105). Social skills include: “reading people and environments, framing lines of action, and mobilizing people in the service of these action frames” (Fligstein & McAdam 2011, p. 7). The emergence of a new line of inquiry under the term ‘institutional work’ (e.g. Hargrave & Van De Ven 2009; Kraatz 2011; Lawrence & Suddaby 2006; Lawrence, Suddaby & Leca 2009; Perkmann & Spicer 2008) is closely aligned with the notion of ‘social skill’. Institutional work has been defined as: “the purposive action of individuals and organizations aimed at creating, maintaining and disrupting institutions” (Lawrence & Suddaby 2006, p. 215). In their major study on institutional work, Lawrence and Suddaby (2006) reviewed empirical research published from 1990 in the publications – *Administrative Science Quarterly*, *Academy of Management Journal* and *Organization Studies* to catalogue prominent examples. Examples of institutional work that they identified include the use of advocacy, mimicry and educating as a means of creating institutions. ‘Mythologising’ and ‘policing’ are examples of institutional work that aim to maintain existing institutions. The term ‘social skill’ is used here, but it may be used interchangeably with the term ‘institutional work’.

This thesis has highlighted that social skills can be observed as playing a central role in connecting stakeholders and focusing their efforts towards energy efficiency improvement. These individual-level skills were exhibited by corporate energy practitioners and supported their efforts to change energy management practices. However, rather than using directly coercive strategies, three particular social skills were observed to be prevalent in this case of changing energy management practices. These distinct, yet interrelated social skills have been identified as playing a central role in the collaborative co-creation of energy management practices, and are:

- framing
- integrating, and
- creating normative networks (see Figure 9.10).

Figure 9.10: Three key social skills supporting collaborative co-creation



Framing

A frame is: "a quality of communication that causes others to accept one meaning over another" (Fairhurst & Sarr 1996, p. xi; Sillince & Mueller 2007). 'Cultural frames' are used by individuals to shape their understanding of situations and guide their actions (Howard-Grenville & Hoffman 2003).

Maguire, Hardy & Lawrence (2004) observed that the institutional entrepreneurs involved in influencing the development of the field of Canadian HIV/AIDS treatment advocacy framed arguments in different ways to appeal to the interests of diverse stakeholders (e.g. the community, treatment advocates, pharmaceutical companies and activists). Howard-Grenville & Hoffman (2003) suggest that, where there are multiple benefits associated with social initiatives, then framing can provide a particularly useful method of engaging stakeholders in the process of institutional change. The findings in this research are consistent with that view.

Framing was used by actors in many different ways as a means of building support for energy efficiency and to access resources. For the Department of RET there were explicit attempts to frame the EEO legislation as a program that delivered business benefits as well as energy cost savings and greenhouse gas emissions. This was even written into the legislation by requiring organisations to assess what the government called "whole-of-business" benefits.[220] This was an attempt to challenge the established perception of energy efficiency as primarily an initiative aimed at reducing energy costs.

For corporate energy practitioners at the nexus between external stakeholders and internal groups, reframing arguments to appeal to different individuals and groups throughout their organisation provided a particularly powerful tool for obtaining support. For example, it was observed that energy efficiency was framed in a number of different ways, including as a:

- risk management strategy
- cost containment strategy
- way of engaging internal staff in their day-to-day work, and
- means of demonstrating an organisation's social responsibility.

Of particular interest is that the content of the framing was adjusted by corporate energy practitioners over time. For example, whereas initial framing tended to be focused around saving energy costs, as external drivers, such as the introduction of a carbon price enhanced the focus for both senior managers and investors, the framing shifted towards a focus on legislative risk and cost containment. Following the global financial crisis in 2008, there was greater focus once again on cost reduction benefits.

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[220]The EEO Industry Guidelines document states that: "The detailed investigation is used to inform whole-of-business evaluation, to inform a full cost-benefit analysis to quantify benefits to business beyond the value of direct energy savings. These could include production efficiencies, reduced maintenance schedules, improvements to operational health and safety, staff comfort and engagement, improved reputational benefits, or changes in other factors that the company views as a business priority."(RET 2011, p. 64)

This research also highlighted that framing at the individual level might be much more personal – tapping into values and emotions. Corporate energy practitioners found that one-on-one discussions were not only useful in understanding which frame might be most appropriate for the individual or group concerned, but these discussions also subtly shaped the framing of the messages in ways that highlight that framing can be more effective as a recursive process. That is, rather than just selecting from a menu of possible 'frames' for a particular stakeholder, the discourse between actors themselves helped to create *new* frames that were somewhat unique to the social context within which they were being delivered. For example, involving decision-makers in the process of identifying and evaluating energy efficiency measures also helped to ensure that business case proposals were framed in ways that made certain that appropriate business costs and benefits were taken into account. Collaboration with decision-makers not only helped to establish the appropriate framing of the project, it also led to greater engagement, interest and commitment from decision-makers, which appears to have helped to increase the likelihood that a project would be implemented. Thus, approaching framing as 'a process of engagement' rather than 'a recipe of options' helped to enhance the benefits of collaboration across actors with different levels of embeddedness.

Framing has been shown to be particularly powerful in relation to energy efficiency due to the multiple benefits that accrue. Acting as a powerful boundary object the notion of energy efficiency provided a shared concept that could be adopted to appeal to the particular interests of individuals and occupational groups (Benn, Edwards & Angus-Leppan 2013; Oswick & Robertson 2009; Star & Griesemer 1989).

Integrating

Corporate energy practitioners frequently used the terms 'integrating' and 'integration' when they described the focus of their efforts to improve and maintain energy management practices in their organisations. There were several advantages to integrating energy management into existing management practices in their organisations. For example, as they sought to broaden the involvement of personnel across their organisations by highlighting ways in which existing management systems or practices could be applied to the task of energy efficiency improvement, they were able to reduce resistance. Also, using existing systems reduced the perception of extra work required or the effort of learning new ways of doing things.

Other terms are closely related and relevant to what might be considered the social skill of 'integrating'. For example, Lawrence & Suddaby (2006, p. 233) used the terms 'embedding' and 'routinising', which they described as: "actively infusing the normative foundations of an institution into the participant's day-to-day routines and organisational practices". Zeitz (1999) described tactics, such as linking a new management practice to organisational identity, as an important mechanism for supporting the adoption and entrenchment of new management practices.

Integrating energy management practices into the day-to-day routines of the organisation presents several effects. A number of these are highlighted by (Becker 2004) and discussed here. For example, routine behaviour is easier to monitor and control than non-routine behaviour. Consequently, routine behaviour helps to reduce uncertainty. For corporate energy practitioners attempting to meet compliance requirements, establishing appropriate routines was considered essential to meeting compliance requirements. Integrating within existing management practices also made it more efficient to conduct energy efficiency assessments since there was less 'reinventing of the wheel' required. Establishing routines also supported learning from one site assessment to another as any variation in approaches could be compared and contrasted – providing feedback that was used to incrementally modify subsequent assessments.

Supported by training, documentation and other material, this may also mean that integrating practices into routines has meant knowledge is more effectively stored within the organisation. This helps address the risk that knowledge is lost when personnel leave an organisation, or (as a number of corporate energy practitioners suggested) energy consultants leave with important knowledge that was developed within the organisation (i.e. the consultant's intellectual property), but not documented or stored appropriately for future use by the organisation. Routines can also provide stability and efficiency since less conscious problem-solving is required to execute particular tasks and skills are progressively developed.

Creating normative networks
Lawrence & Suddaby (2006, p. 225) define normative networks as: "the inter-organizational connections through which practices become normatively sanctioned and which form the relevant peer group with respect to compliance, monitoring and evaluation". Of note is that Lawrence and Suddaby use the term 'constructing'. However, this term tends to imply a greater level of direct control than was observed in the research. The term 'facilitation' has more of a connotation of *creating* the conditions to enable interaction amongst individuals and groups, rather than coercively designating them to particular networks. Therefore, this is the term that is used in this discussion.

Although Lawrence and Suddaby classify the construction of normative networks as being prominent in the process of *creating* institutions, in this case study we observe that it is part of both *disrupting* and *maintaining* institutions. This is consistent with Zietsma & McKnight's (2009) study of new forestry practices in Canada. They found that institutional creation, maintenance and disruption work often occurred at the same time. In this research, the normative networks that were formed to disrupt existing management practices were often modified for the process of creation and maintenance of these networks.

The case study highlights how normative networks were established at both the field and organisational levels. For example, the annual conferences that were hosted by the Australian Government provided a location in which corporate energy practitioners could share their experiences and interact to form networks of people with a distinct professional interest. Within organisations, normative networks included energy teams and networks of site-based energy managers which supported learning across the organisation. An important key to creating normative networks was to work across structural and professional boundaries. This helped to draw on the unique strengths individuals and groups in particular parts of an organisation had in relation to their particular level of embeddedness.

Fligstein (1997) refers to tactics that relate to the facilitation of normative networks such as 'aggregating interests' and 'networking to outliers who have no coalitions'.

Aggregating interests involves joining together actors or group with different preferences to create a collective identity around a new issue. Newly established networks may be formed or developed by drawing in ‘outliers’ who have no collective identity into a network to further reinforce support for and replication of new practices. Both of these tactics were observed and were prominent in this research. For example, operational personnel may be considered outliers in that they are directly involved in day-to-day operations, but in some organisations, their perspectives on operational practices may not be sought. In the process of engaging staff in energy efficiency improvement, such personnel may be provided with an opportunity to share their perspectives. Where there are changes that lead to improved energy efficiency then operators may use the energy efficiency team or improvement process to help them realise the operational changes that they seek.

9.3.5 Condition 4 – Shifts in institutional logic underpin institutional change

‘Institutional logic’ refers to the underlying belief systems that inform the behaviour of actors within an institutional field (Scott 2001). It has the effect of providing the organising principles for a field (Friedland & Alford 1991) and influencing individual and organisational behaviour when they relate to the collective identities of a social group (Thornton & Ocasio 2008). Polleta and Jasper (2001, p. 285) define a collective identity as: “an individual’s cognitive, moral, and emotional connection with a broader community, category, practice, or institution”. Institutional logic plays a fundamental role within organisational fields by creating common purpose and alignment amongst field constituents. It supports understanding of institutional change, as shifts in a dominant logic can provide an important indication of change (Reay & Hinings 2009). Three major shifts in the institutional logic that informed the enactment of energy management practices were observed in this case research (see Table 9.5). These shifts informed the development and maintenance of new energy management practices amongst the organisational field associated with energy management practices.

Table 9.5: Shifts in institutional logic

Shift in logic	Old rationale	New rationale
From outsourcing to internal engagement and capacity building	• External consultants seen to have the credibility and legitimacy to conduct energy efficiency assessments • Outsourcing considered a means of minimising the resources required to deliver energy efficiency improvement	• Dispersed nature of decision-making and perspectives on energy use required involvement and skills development of personnel from across the organisation
From energy savings to business value	• Main value associated with energy management consisted of reducing input costs associated with energy use which contributes to incremental change	• Energy management perceived as an opportunity to deliver multiple organisational benefits which contributes towards transformative change *as well as* incremental change
From episodic to continuous improvement	• Energy efficiency assessments – primary means of managing energy use • Conducted on a semi-regular basis (e.g. every 3-5 years)	• Energy management considered a process of ongoing management, including at the level of day-to-day review and modification of operational practices to save energy

The first shift was from outsourcing to internal engagement and capacity building.

That is, the institutionalised practice had been to outsource energy management to a consultant as consultants had perceived credibility and legitimacy (by key stakeholders). However, this shifted as it was realised that more effective outcomes could be achieved by involving a range of people across professional and structural boundaries across the organisation. To facilitate their involvement briefings, training and other capacity building activities are implemented.

Second, energy efficiency was perceived to be an activity that mainly achieved savings in energy costs. This underlying assumption shifted as organisations found that energy management could deliver energy savings and a range of more far-reaching business outcomes, therefore, justifying further investment and attention to energy management.

The third shift related to the frequency with which attention and effort was placed on energy management. The change moved from a belief that energy management only required periodic attention by conducting energy audits once every few years, to a new belief where there was value placed on ongoing attention to energy management. This included a review of energy data on a day-to-day or shift-to-shift basis (i.e. increased frequency) to deliver improved energy and operational performance.

9.3.6 Section summary

This section of the thesis has described the implications of the research for the paradox of embedded agency and institutional change. It began by highlighting that the process of institutional change observed in this research can be characterised as 'collaborative co-creation'. Then, the following four conditions supporting institutional change as a process of collaborative co-creation were discussed:

1. stakeholders with multiple levels of embeddedness are engaged in the change process
2. roles emerge for institutional entrepreneurs
3. collaboration is created through the enactment of constructive social skills, and
4. change is underpinned by shifts in institutional logic, by which diverse stakeholders create shared understanding of newly-created energy

management practices.

The next section considers the practical implications of the research/

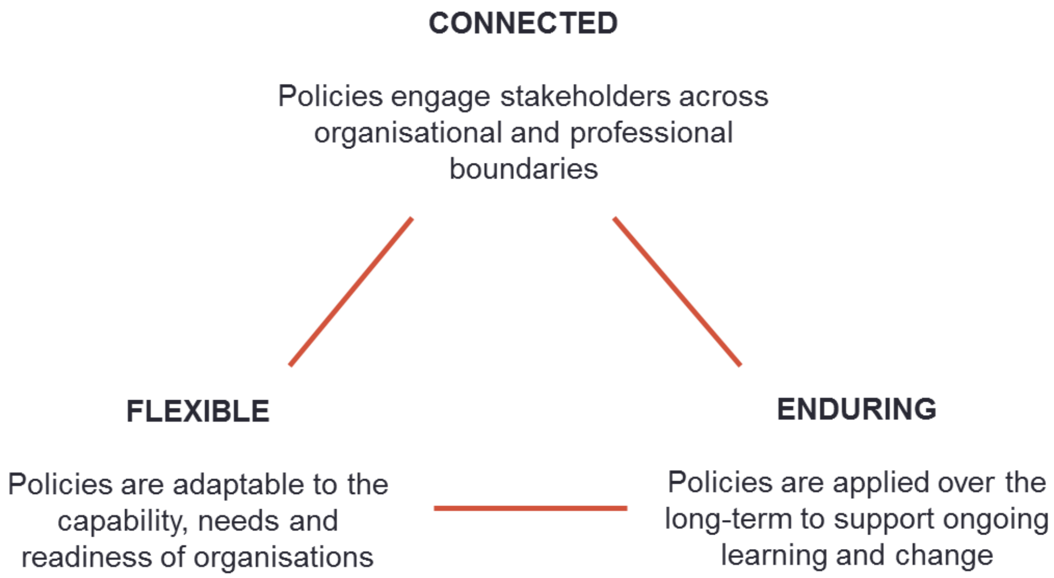
9.4 At the level of practice: implications for policy development

The findings on institutional change have important implications for energy efficiency policy development. In Chapter 4, the literature on energy efficiency policy was reviewed with a particular focus on how policies aim to encourage the adoption of energy management practices. That review highlighted that there are many different factors influencing energy use in organisations, including the design of energy markets, economic environment, business circumstances, managerial priorities and a wide range of implementation barriers (Tanaka 2011). As a result, policymakers typically approach energy efficiency policy by developing multiple policies that are linked together as 'policy packages' (Jollands et al. 2010; Price et al. 2005; Ürge-Vorsatz & Novikova 2008; Zhou, Levine & Price 2010). While this is an appropriate response to the complexity associated with the adoption of energy management practices in organisations, there is also a potential for unintended consequences from the implementation of energy efficiency policies. For example, organisations may respond to policy as an administrative burden and adopt a 'compliance' approach that places an emphasis on meeting the minimum requirements of the legislation rather than improving their energy efficiency and business performance (Shen, Price & Lu 2012). Also, financial and market-based measures that aim to modify the price of energy may be ineffective unless organisations are aware of and manage their energy use effectively, thus impacting on the extent to which such programs are able to encourage improved energy performance (Garnaut 2008; Tanaka 2011).

These unintended consequences and limitations were reflected in the initial response by organisations to the EEO legislation; that is, organisations applied established energy management practices that were widely 'taken for granted' as 'the way to do energy management.' And yet, over time these energy management practices changed in the organisations involved in this study. These changes may be attributed, in part, to policy mechanisms (e.g. the EEO legislation). Ultimately, it is clear, however, that the dynamic interaction between multiple government policies and other changes in the organisational field influenced change.

This research identified four conditions supporting the adoption of energy management practices in organisations through a process of collaborative co-creation. On the basis of these conditions, three key policy development principles that may be applied to encourage the adoption of energy management practices have been derived (see Figure 9.11).

Figure 9.11: Implications of the research for policy development and implementation



First, policy measures should be *connected*. That is, energy efficiency policies should encourage a wide range of stakeholders to engage in the process of energy efficiency improvement. This principle is intended to address the limitation of policies that have focused on technical personnel and technology improvement without broadening engagement to the wide range of other professions and stakeholders who play an important role in overcoming barriers to energy efficiency improvement. This approach also reduces the risk that managers will delegate energy efficiency to personnel who may already be overloaded with inadequate resources.

Second, to encourage the adoption of effective energy management practices, it is argued that policy measures should be *enduring*. That is, there should be policy and program stability over a period of time to provide organisations with a level of consistency that can help them to develop and adopt new energy management practices. This principle acknowledges that changes in energy management practices require deep shifts in beliefs as well as changes in technical activities.

Third (and finally), policy measures should be *flexible* in their application. This principle is intended to support organisations with different capabilities and degrees of energy management sophistication to adopt the appropriate practices that will progress energy management most effectively for them.

9.4.1 Towards better connected policies

Identify and involve multiple stakeholders in energy efficiency improvement

This research has highlighted the complex social environment associated with energy management. A wide and growing range of stakeholders have augmented their interest in the energy efficiency performance of organisations across the study period. This presents an opportunity for policymakers to leverage the influence of stakeholders with an interest in energy management. Such leverage may be enhanced by providing education and training programs and by upskilling professionals and organisations with limited experience with energy management. For example, middle/senior managers within organisations and external advisors who are focusing solely on core business issues, such as financial management and accounting, may not be aware of the strategic benefits associated with improved energy management.

This was, however, achieved in the NSW Government Energy Efficiency Training Program. As part of this program, the University of Technology Business School undertook a training needs analysis to determine the interests and needs of the accounting profession. One important outcome was that professional industry associations were in the process of promoting the role of accountant as a ‘business partner’. They identified that energy efficiency was an issue that accountants could promote to senior management (Benn et al. 2011). In this case, the NSW Government played a role of coordination between industry associations, universities, technical education institutions and practitioners to raise awareness and provide skills to support energy efficiency improvement. This is just one illustration of the important role that government can play in creating ‘normative networks’ between stakeholders with diverse professional interests that may not have previously perceived a shared interest and opportunity for collaboration with others.

From this point of view, energy efficiency may also be used by educators to demonstrate their efforts at renewal and in highlighting the relevance of their courses in the context of contemporary issues.

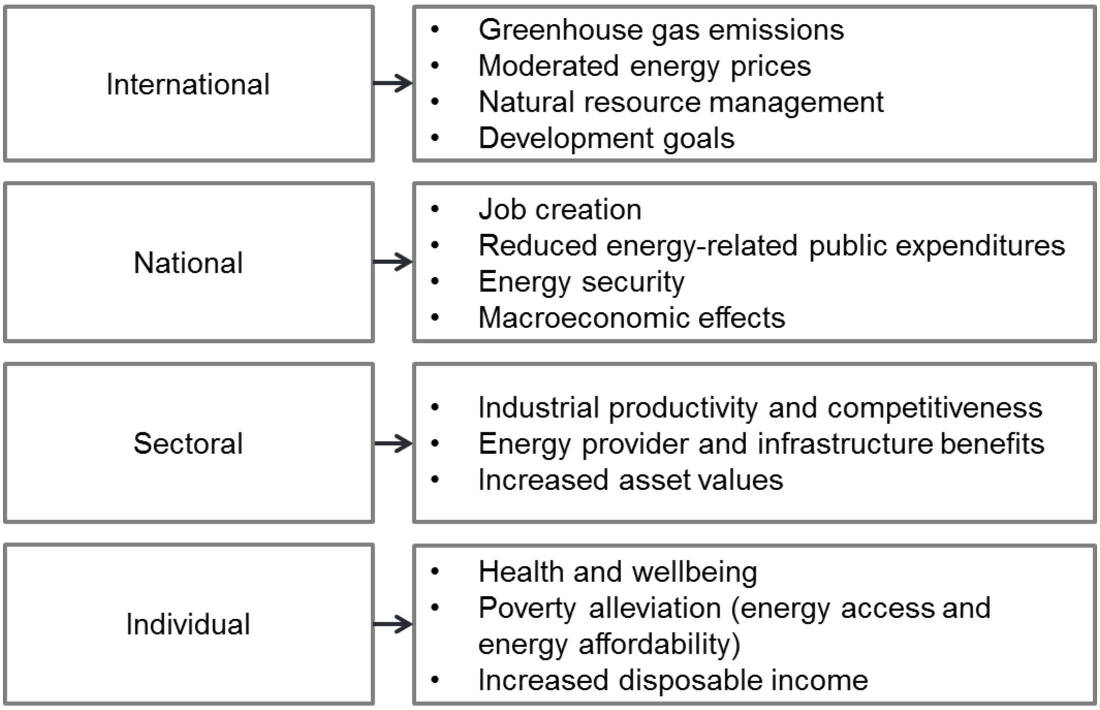
Communicate the multiple benefits of energy efficiency

One of the strengths of energy efficiency is that using less energy to produce goods and services can deliver multiple benefits. A number of these benefits were identified in the case study and in the previous discussion on the social skill of 'framing'. Reframing energy efficiency can also be done at the national and international levels. It has recently been acknowledged that the full benefits of energy efficiency have not been effectively communicated by governments. This may have the effect of limiting the extent to which other government department and businesses themselves value policies and initiatives that aim to accelerate energy efficiency improvement (Ryan & Campbell 2012).

The recent IEA report *Spreading the Net: The Multiple Benefits of Energy Efficiency Improvements* (Ryan & Campbell 2012) provides a preliminary assessment of the work that has been undertaken to quantify the multiple benefits from energy efficiency. In Figure 9.12, the benefits of energy efficiency are presented at multiple levels, including international, national, sectoral and individual levels. The work builds on other attempts to determine the macro-economic benefits of energy efficiency. For example, Barker, Ekins and Foxon (2007) studied the macro-economic effects of energy efficiency policies and programs in the United Kingdom between the years 2000–2010. This study, which covered the domestic, business, commercial and transport sectors, found that the energy efficiency policies that had been implemented across these sectors led to a saving of around 8% of the energy that would have otherwise been used. The positive macro-economic effects included lower prices and lower inflation as production systems required fewer inputs to produce the same output. Higher output and growth was also found – in the order of a 0.1% increase in the annual gross domestic product growth rate over the period 2005–2010.

Figure 9.12: ‘Levels’ typology of the multiple benefits from energy efficiency improvement

(Source: Ryan & Campbell 2012, p. 15)



An example of the way in which the benefits of energy efficiency may be reframed by governments is presented in the following quote from the Australian Government’s Energy White Paper of 2012 (RET 2012c, p. 179). In this quote, the words ‘energy productivity’, rather than ‘energy efficiency’ are used.

> “Improving energy productivity involves increasing the ratio of economic output or social utility relative to the cost of the energy used in their production. At its core it involves the efficient generation, distribution and use of energy. Improved productivity can reduce the need for investment in energy systems and lower energy and carbon costs for households and businesses. However, achieving sustained economic, social or environmental benefits requires the whole supply and end-use chain to operate efficiently.”

This concept attempts to link energy end-use more clearly with the full life cycle of energy supply. The term ‘productivity’ may be considered more appealing to businesses and government stakeholders and more in alignment with national economic jargon (Boyd & Pang 2000; He, Liu & Zhang 2006; Honma & Hu 2009).

To ‘leverage’ this framing however, requires education, training and collaboration processes that bring together diverse stakeholders across the supply chain to identify and enact change.

9.4.2 Towards more enduring energy efficiency policies

The case study highlighted that the organisational field associated with energy management practices was dynamic and changing over the six years that were examined. The EEO legislation provided an important trigger for companies to reconsider their energy management practices, and this was then reinforced through the influence of other government legislation and growing interest from investors and customers. As well as providing a trigger, however, the EEO legislation also provided continuity and focus for organisations as they sought to manage the broadening interest in energy management from external stakeholders (e.g. investors and customers). Of note is that – even after the first five-year period of the program (which concluded in June 2011), the corporate energy practitioners that presented at the annual EEO conferences emphasised a number of significant changes that they were intending to make as they planned for the second five-year EEO assessment cycle. These organisations had already delivered substantial energy efficiency improvements, yet saw significant further potential.

Continuing attention to energy efficiency is required for a number of reasons – by policymakers as well as practitioners. For example, technology improves, energy prices fluctuate and there is a need to purchase new equipment and refurbish existing equipment from time-to-time. An important characteristic of organisations that have been successful in improving their energy efficiency performance is an ability to maintain the focus on energy management, to review their effectiveness and implement new practices that support continuous improvement. The enduring nature of the legislation played an important role in supporting an ongoing focus on energy efficiency improvement. At the time of writing the EEO legislation had provided a consistent driver for change over more than seven years in a period when related government policies had been modified substantially and stakeholder interest and concern was augmented.

This finding highlights the need for energy management policies to provide consistency and longevity in order to support improvements in energy management practices which, in turn, deliver improved energy efficiency performance. There are a number of design features in the EEO legislation that encourage continuous improvement and supported learning and continuous improvement:

- There is the option for organisations to sequence their energy efficiency assessments over a five-year period, rather than conducting them in one particular year. This approach supported reflection and learning from one site assessment to the next.
- At the commencement of the program and at the commencement of each five-year assessment cycle, organisations are required to submit an Assessment Plan outlining the detail of how they will conduct their assessments and meet other requirements. This encourages organisations to review their experience in each five-year assessment cycle and to propose improvements in subsequent cycles.
- Annual conferences and published case studies present a learning opportunity for corporate energy practitioners. They can share their experiences in a peer-to-peer learning environment.
- Annual reporting contributed towards greater visibility for senior managers and external stakeholders regarding the extent to which energy performance is improving in each organisation. It also encouraged the organisations themselves and other stakeholders to compare the energy efficiency performance of one organisation with another.

These design features appear to encourage energy efficiency improvement more effectively than the technical task of identifying opportunities through an energy efficiency assessment alone. They encourage reflection and learning that contributes towards changing beliefs about how energy management 'should be done'. This, in turn, informs the development and implementation of new and more effective energy management practices within organisations.

These findings are consistent with other research that underlines the importance of policy and program continuity. For example, Therkelsen (2013) found that implementation rates of energy efficiency measures improve over time. In reviewing

China's energy efficiency auditing policies, Shen (2012) highlights the benefits of long-term and enduring policies in supporting coordination across local, regional and national measures to create deeper cultural change than is possible with short-term, disparate policy approaches.

9.4.3 Towards more flexible policies

Researchers have called for energy efficiency policies to be appropriately targeted to situations that particular organisations find themselves in, thereby acknowledging the heterogeneity of organisations (Allcott & Greenstone 2012; Allcott, Mullainathan & Taubinsky 2012; Christoffersen, Larsen & Togeby 2006; Gillingham & Palmer 2013; Mallett, Nye & Sorrell 2011). However, the challenge that arises is how to determine the different levels of sophistication and readiness, and the policies that are most appropriate to their needs.

Chapter 3 described a number of empirical studies into energy management, including studies in the Danish manufacturing sector (Christoffersen, Larsen & Togeby 2006), Swedish pulp and paper industry, the foundry industry (Thollander & Ottosson 2010) and the Turkish iron, steel, cement, paper, ceramics and textile industries (Ates & Durakbasa 2012). Although the energy management practices examined differ in some respects, one limitation of this approach has been the way it has been presented as a means of identifying the organisations that *do* practice energy management and the organisations that *do not*.

However, the research conducted in this thesis highlights the relevance of viewing energy management practices as developing along a continuum. There is a degree of energy management *practiced* in every organisation. At the most basic level, this may be associated with decisions around energy procurement. However, the approach may became increasingly more sophisticated by broadening the types of people involved in energy management, improving energy information systems and continually scanning changes in the wider environment beyond organisations to understand emerging business risks and opportunities, as well as dealing with the emergence of new technologies.

Organisations and policymakers may develop diagnostic tools to assess the level of existing capability and business context that may be used to determine the most appropriate intervention strategies. The model developed in this thesis could be used to inform the development of such tools. For example, at the level of the organisational field, the external drivers for change may be examined. This differs from one industry sector to another. For example, the influence of investors appears to have been greater in the commercial property sector than others. In part, this is due to the development of a simple measure, the NABERS Energy rating, that allows investors and others to easily compare the energy efficiency performance of one organisation in the sector to another. There may also be different legislative requirements, levels of customer interest and even differences in the availability of technical expertise and energy consultants.

At the organisational level, it could be useful to analyse the extent to which the three major shifts in institutional logic have occurred. Such a review would examine the extent to which energy management is approached on an episodic or ongoing basis, and the extent to which energy management is integrated within the organisation. Reviewing the process through which projects are evaluated and presented to management could also help to identify appropriate interventions.

The research suggests that working with groups of companies with similar levels of energy management practices and performances could improve policymakers' understanding of the most appropriate policy measures that could be applied. An additional benefit of this approach is that it would build local support and also build on or create normative networks within and across industry sectors to provide a foundation for ongoing energy efficiency improvements.

9.5 Key contributions in summary

This thesis set out to provide new perspectives on institutional change by examining how and why energy management practices changed in Australia over the period 2006–2012. In doing so, the thesis has responded to the call from researchers to provide new perspectives on persistent societal challenges, such as climate change, through the application of institutional theory (Kraatz 2011; Scott 2010; Stern & Barley 1996).

The thesis offers the following four key contributions to the academic literature:

1. *Original and empirically tested insights into the conditions that support institutional change as a process of 'collaborative co-creation'*: It adds to the understanding of the process by which multiple organisations are involved in experimentation, negotiation and consensus-building processes which disrupt previously institutionalised energy management practices and inform the development and maintenance of new and more effective practices. This perspective on change contrasts with the more widely recognised dialectical model of institutional change. According to the dialectical model, change is characterised as a process of 'institutional war', which is waged between powerful actors (DiMaggio 1988; Hoffman 1999; Reay & Hinings 2005). This finding supports the musings of Zietsma and McKnight who state (2009, p. 225): "We expect that this co-creation process by multiple actors of different types is much more common than the current literature suggests" (2009, p. 225).

2. *Novel insights into how and why the interactions between stakeholders with varying degrees of social embeddedness play an important part in the dynamic processes of institutional change*: This contribution extends the work of Reay, Golden-Biddle and Germann (2006) who challenged the view that embedded actors create barriers to change. Instead, they found that deeply embedded actors can play a constructive role in progressing institutional change. The present study has demonstrated how the processes by which the interactions between stakeholders with varying degrees of embeddedness contribute constructively to institutional change. This contribution also addresses the call from researchers for institutional researchers to examine the 'paradox of embedded agency' by

exploring the interactions and influence multiple distributed stakeholders have/experience. The notion of distributed agency is that institutional change occurs through the interactions of multiple actors distributed across status, time and levels of influence (Lawrence, Suddaby & Leca 2011; Lounsbury & Crumley 2007, p. 1007).

3. *It responds to the call from researchers to balance analysis at the level of the institutional field with examination at the individual level* (Battilana & D'Aunno 2009; Fligstein & McAdam 2011; Hwang & Colyvas 2011; Lawrence, Suddaby & Leca 2011; Lawrence, Suddaby & Leca 2009; Zietsma & Lawrence 2010): Specifically, the research identified three key social skills that institutional entrepreneurs apply to progress institutional change. Corporate energy practitioners act as institutional entrepreneurs by reframing the benefits of energy efficiency to engage stakeholders, creating normative networks across structural and professional boundaries, and by integrating energy management into existing business practices and management systems.

4. *Finally, this thesis contributes to the energy efficiency literature*: Researchers have highlighted the need for novel theoretical approaches to be applied in order to improve understanding of the phenomenon of the energy efficiency gap and how it might be addressed (Biggart & Lutzenhiser 2007; Palm & Thollander 2010; Shove 1998). The research has achieved this by developing an empirical model that supports analysis at multiple levels. In particular, it contributes to the literature by extending established theoretical perspectives and empirical work to the examination of the interorganisational level. The thesis has also contributed practical, specific insights that can be applied by policymakers as they review and develop energy efficiency policies that aim to accelerate the uptake of effective energy management practices in organisations in order to resolve the gap between actual and optimal energy use in organisations.

9.6 Limitations and suggestions for further research

This study has certain limitations. The study focused on the changing management practices of large energy consuming organisations in Australia as a single case. Different results may be generated if this study is conducted with organisations in specific industry sectors, in smaller organisations and in different national contexts. It is suggested that further research could replicate the application of the model advanced in this thesis in different contexts. For example, the development of the NABERS Energy rating system in the commercial building sector was referred to in this thesis since this had proven to be a substantial enabler of improved energy efficiency performance in that sector. A commercial focus would allow the development and application of the rating system to be examined in more detail. This could present a useful case by examining:

- which stakeholders were involved in its development
- how rating systems like NABERS Energy support communication across organisational and professional boundaries, and
- the role and skills of the 'institutional entrepreneurs' involved to develop the perceived legitimacy of the ratings tool.

Another example of the usefulness in taking a sectoral approach is shown in the transport sector. The transport sector was a relative newcomer to formalised energy efficiency assessments when the EEO legislation was first introduced. However, the organisations from the transport sector that were involved in the study saw significant gains – particularly through behavioural initiatives, such as driver training. Examining change within the sector could provide researchers and policymakers with a better understanding of why an industry in which energy is a very high proportion of operating costs had been able to make such substantial improvements over the first five-year cycle of the EEO legislation.

Further research could also involve replicating the model and comparing one country context to another. For example, the energy management practices within the Australian commercial sector could be compared with the practices and energy efficiency performance in other countries. This approach could present a particularly useful extension of this research since there is evidence that the larger and stock exchange-listed property companies in Australia have been assessed as consistently higher in their environmental management practices and performance (of which energy efficiency is a part) compared to the commercial sector organisations in other countries (Bauer, Eichholtz & Kok 2010; Eichholtz, Kok & Yonder 2012; GRESB Foundation 2011, 2012). Therefore, a study comparing the leading organisations in each country could present useful insights into the different energy efficiency policies, economic and social influences that contribute towards improved energy efficiency performance and the adoption of effective energy management practices.

Whilst it may be challenging to replicate the annual conferences which served as field-configuring events in the current study, smaller workshops which encourage leading practitioners to share their experience may provide a fruitful avenue to gather data at the same time as participants share their experiences and learn from each other.

Small and medium enterprises present a number of unique challenges with regard to energy efficiency improvement. Particularly in relation to accessing resources and having the time required to focus on energy efficiency improvement. Several useful studies have already focused on this sector (e.g. (Côté, Booth & Louis 2006; Kannan & Boie 2003; Trianni & Cagno 2012). Further research could develop exemplary cases as a powerful means of demonstrating what is possible within a sector where there are significant barriers. Further research could attempt to clarify the different factors that influence the likelihood of success in relation to energy efficiency interventions using techniques such as lifestyle categorisation (Palm 2009) to group ‘types’ of organisations.

As well as suggesting that the model used in the present study be applied more widely, this thesis has also exposed a wide range of theoretical approaches that may be applied to the problem of the energy efficiency gap. In particular, the brief review of the organisational change literature suggested that the work on organisational change could be more effectively integrated into both research and practice associated with energy efficiency. There is scope for detailed case studies at the organisational level that delve into finer detail than was possible in this study, to understand the dynamics of change in relation to energy efficiency within organisations.

Finally, is it suggested that future research examine the promotion and take-up of the ISO 50001 Energy Management System standard. Since this standard has a high profile and the support of organisations and governments around the world (Goldberg et al. 2012; McKane, Scheihing & Williams 2008; McKane et al. 2008; Price et al. 2008; Reinaud, Goldberg & Rozite 2012), it presents an opportunity to significantly accelerate the energy efficiency improvement in organisations. However, as this and other research has shown, the way in which new systems and practices are introduced and implemented within an organisation can have a significant influence on their success. Future research should learn from the experience with the ISO 14000 Environmental Management standard (Könnölä & Unruh 2007; Nawrocka & Parker 2009) and ensure that appropriate research is undertaken to leverage the ISO 50001 standard in a way that maximises outcomes while minimising the potential for unintended consequences, such as organisations treating energy management as an administrative or compliance initiative, rather than as an intervention that can deliver significant environmental, social and economic benefits (Shen, Price & Lu 2012).

10. Conclusion

This thesis set out to contribute new perspectives on the dynamics of institutional change in order to provide important contributions to the academic literature. In terms of practice, the aim has been to provide insights into the actions that policymakers and other stakeholders can take to accelerate the adoption of effective energy management practices in organisations.

Chapter 2 outlined the reasons why energy efficiency is an urgent economic, social and environmental issue. Chapters 3 and 4 then examined the academic energy efficiency literature to identify what is known about 'the energy efficiency gap' and the role that energy management practices can play in resolving it. From the review of the energy efficiency literature, the primary research question examined in this thesis emerged. That is:

How and *why* do energy management practices change?

This question has been supported by three secondary research questions.

1. How do corporate personnel with responsibility for energy efficiency improvement influence the development and adoption of energy management practices?
2. How do different stakeholders influence change?
3. What are the triggers that precipitate change in energy management practices?

Chapter 5 outlined the theoretical framework for the thesis by reviewing the institutional theory and institutional entrepreneurship literatures. It was argued that institutional theory provides an appropriate theoretical framework to meet the research aims. Review of these literatures informed the model developed for the analysis which incorporates four central characteristics. The model:

- supports multi-level analysis
- exposes the skills and strategies of individual 'institutional entrepreneurs'
- accounts for the interactions between multiple stakeholders as they influence

institutional change, and

- supports analysis of the dynamic process of changing practices over time.

Chapter 6 then described the research design in detail including the reasons for and features of the embedded, single-case study design, the sources of data and the analysis techniques applied in the research.

The case study of changing energy management practices in Australia 2006−2012 was presented in Chapters 7 and 8. The case began with an explanation of the historical context that informs energy efficiency policy in Australia. It then examined the energy management practices that were applied in large energy consuming organisations as they initially responded to the EEO legislation which commenced in July 2006. Then, the rising interests of stakeholders in the organisational field were identified before the process of changing and maintaining new energy management practices was examined.

Chapter 9 discussed the findings from the research within and across the different levels of analysis. These are, the organisational field, the organisational and the project-levels. Four conditions that support successful institutional change as a process of collaborative co-creation emerged from the research. These conditions are that:

- stakeholders with multiple levels of embeddedness are engaged in the change process
- roles emerge for institutional entrepreneurs
- collaboration is created through the enactment of constructive social skills, and
- change is underpinned by shifts in institutional logic, by which diverse stakeholders develop shared understanding of newly-created energy management practices.

The implications of the research for energy efficiency policy development were then considered. It was argued that energy efficiency policy measures should aim to be:

- *Connected*. That is, policies should encourage a wide range of stakeholders to engage in the process of energy efficiency improvement. This includes greater collaboration between government departments with energy efficiency-related policies.

- *Enduring*. Policy-makers should aim to create policy and program stability over a period of time to provide organisations with a level of consistency that can help them to develop and adopt new energy management practices.
- *Flexible.* This can improve the extent to which policies influence change by targeting the different capabilities and degrees of energy management sophistication within organisations.

The thesis offers the following contributions to the academic literature:

1. Original and empirically tested insights into the conditions that support institutional change as a process of 'collaborative co-creation'
2. Novel insights into how and why the interactions between stakeholders with varying degrees of social embeddedness play an important part in the dynamic processes of institutional change
3. New perspectives on the role and social skills of individuals in institutional change, and
4. New perspectives on the energy efficiency gap and how it can be resolved through the adoption of effective energy management practices.

A number of important opportunities for future research were identified. In particular, it was highlighted that by applying the model developed in this thesis to examine the adoption of energy management practices within other country and industry specific contexts, further understanding of institutional change and ways to accelerate the uptake of effective energy management practices will be forthcoming.

Ultimately the motivation of this research has been to inform action that will accelerate the implementation of energy efficiency projects to deliver on the significant economic, social and environmental benefits that energy efficiency offers. It is hoped that this research can play a small part in sharing the experiences of effective practitioners and to highlight the power of effective communication and collaboration to create value for people and society as we address the urgent need to minimise the economic, social and environmental impacts of climate change.

11. Appendices

11.1 Conference papers and presentations

Table 11.1: Conference papers and presentations

Authors, date and title	**Conference**
Crittenden, P. & Lewis, H. 2011 ‘Accelerating the uptake of energy efficiency in industry – a case study of the Australian Energy Efficiency Opportunities program’.	Energy efficiency first: The foundation of a low-carbon society, European Council for an Energy Efficient Economy 2011 Summer Study, Belambra Presqu'île de Giens, France.
Crittenden, P. 2011 ‘Transforming energy sub meter data into results in commercial buildings – evaluation of an innovative training program in Sydney, Australia’.	Behavior, Energy and Climate Change (BECC) Conference Nov. 29 – Dec. 1 2011, Washington, DC.
Crittenden, P. & Lewis, H. 2012 ‘Influencing financial decisions on energy efficiency: six key strategies to build management support’.	American Council for an Energy-Efficient Economy, Summer Study on Energy Efficiency in Buildings, Pacific Grove, California, USA.
Crittenden, P. 2012 ‘Integrating energy efficiency into core business practices: An institutional work perspective on the implementation of energy management systems’.	European Council for an Energy Efficient Economy, Industrial Summer Study, Arnhem, the Netherlands.

11.2 Interview questions

- Please briefly describe your role and responsibilities with regard to energy management in your organisation.
    - How long have you been in this role in your organisation?
    - Has the nature of your role changed over the past few years?
    - If so, how has it changed?

- Are there any specific events (within or external to your organisation) that you can recall that had a strong influence on the way in which your organisation has viewed energy management over the past few years?

- Do you consider that your organisational stakeholders have a greater interest in your organisations approach to energy management than they did five years ago?
    - If so, who are the key stakeholders that have an interest in energy management?
    - How have those stakeholders influenced your organisations approach to energy management?

- When the Energy Efficiency Opportunities (EEO) legislation commenced in 2006, how did your organisation conduct the first energy efficiency assessments required under the legislation?
    - To what extent did you use consultants external to your organisation?
    - What was the rationale for using external consultants?
    - To what extent did you use internal staff?

- What was learnt from the way in which these first assessments were conducted?
    - Describe what worked well and why.
    - Describe what didn't work well and why

- How did your organisations approach to conducting energy efficiency assessments change when subsequent energy efficiency assessments were conducted?

- How does your organisation intend to approach energy efficiency assessments differently in the second five-year energy Assessment Cycle of the Energy Efficiency Opportunities program (i.e. the period 2011-2016)?

- Reflecting on your own role, what actions have you taken to influence the way in which energy management is conducted in your organisation?

- What do you consider the main benefits of energy management to be?

- Has your or your organisation's view of the main benefits of energy management changed over the past few years?
    - If so, why do you think they have changed?

11.3 Key elements and requirements of the EEO Assessment Framework

The ‘EEO Assessment Framework’ outlines the key requirements that companies have to meet in order to comply with the EEO legislation. A detailed summary of those key requirements are provided in Table 11.2.

Table 11.2: Summary of the key requirements of the EEO Assessment Framework

Key element	Summary of the key requirements
1. Leadership	• Sufficient resources are made available to enable a rigorous and comprehensive assessment to be completed. • Senior management support for the assessment must be communicated clearly, and includes energy efficiency assessment or energy use objectives. This is intended to provide direction, legitimacy and encouragement from senior and operational management to those involved in the assessment.
2. People	Personnel with the appropriate level of technical expertise, as well as personnel who influence energy use on a daily basis through operational decisions, are involved in the assessment to: • broaden the pool of potential opportunities identified by drawing on a range of perspectives and experience • improve understanding of the full range of costs, benefits and implementation issues associated with each of the opportunities • build ownership and motivation for the implementation of projects across functional and professional boundaries • encourage the involvement of people in the assessment process who will be necessary for the project to be funded.
3. Information, data and analysis	• Business contextual information is considered so that energy efficiency projects can be reviewed within the context of other business priorities. • The accuracy of facility-level data must be within ±5% for each fuel type. • Energy analysis tools, such as an energy mass balance, are used to encourage consideration and evaluation of opportunities at different

Key element	Summary of the key requirements
	levels of the business, including: – system-wide opportunities – within sub-system opportunities – opportunities for individual processes, and – opportunities associated with individual items of equipment. • An energy mass balance identifies where energy us used and 'lost'. Companies are asked to think about the theoretical minimum level of energy use rather than industry benchmarks to identify areas of unnecessary energy use. • A range of data analysis approaches must be applied to improve the rigour and comprehensiveness of the assessment, including the identification and evaluation of opportunities.
4. Opportunity identification and evaluation	• A systematic process combining the analysis of energy and production data with review and interrogation by a range of personnel must be part of the assessment to broaden the pool of potential opportunities identified. • The process encourages personnel within the firm to share their ideas openly. • The process encourages unsubstantiated assumptions to be tested using objective data, combined with evidence-based analysis to challenge individual and group assumptions about energy use and production processes. • All opportunities with a potential four-year payback must be evaluated. • Detailed investigation is conducted to an accuracy level of ±30%. • All quantifiable business costs and benefits must be included in the evaluation of opportunities to provide a more complete evaluation, rather than the sole focus being on energy-related costs and benefits.

Key element	Summary of the key requirements
5. Decision-making	• Managers responsible for investment decisions must review and then determine the business response to each of the identified opportunities evaluated. • Timelines, resources and accountabilities are allocated for projects to be adopted or evaluated further.
6. Communicating outcomes	• Senior management and the board must review and note the outcomes of the assessment and consider these in relation to strategic business issues, including energy. • Senior management and the board must review the EEO report each year. • The outcomes from the assessment must be communicated by senior managers to those involved in the assessment and across the organisation.

(Source: Crittenden & Lewis 2011, p. 800)

11.4 Data sources for the empirical research

	Code	Job title	Sector	Involvement	Year
1	Presenter AA	GM Carbon & Energy	Mining	Presentation	2011
2	Presenter AB	Chief Engineer	Manufacturing	Presentation	2011
3	Presenter AC	Energy Analyst	Manufacturing	Presentation	2011
4	Presenter AD	Principal Greenhouse & Energy	Manufacturing	Presentation	2011
5	Presenter AE	Energy Engineer	Manufacturing	Presentation	2011
6	Presenter AF	Group Environment Manager	Mining	Presentation	2011
7	Presenter AG	Manager Energy and Emissions Projects	Mining	Presentation	2011
8	Presenter AH	Manager Greenhouse & Sustainability	Mining	Presentation	2011
9	Presenter AI	Maintenance Superintendent	Transport	Presentation	2011
10	Presenter AJ	Principal Energy Efficiency Engineer	Manufacturing	Presentation	2011
11	Presenter AK	Manager, Climate Change and Environment	Commercial	Presentation	2011
12	Presenter AL	Energy Project Engineer	Manufacturing	Presentation	2011
13	Presenter	Head of	Commercial	Presentation	2011

	Code	Job title	Sector	Involvement	Year
	AM	Sustainability			
14	Presenter AN	Director of Consultancy	Commercial	Presentation	2011
15	Presenter AO	Director of Consultancy	Commercial	Presentation	2011
16	Presenter AP	Energy & Sustainability Manager	Commercial	Presentation	2011
17	Presenter AQ	Sustainability Manager	Commercial	Presentation	2011
18	Presenter AR	Head of Finance Products	Commercial	Presentation	2011
19	Presenter AS	Chief Financial Officer	Commercial	Presentation	2011
20	Presenter AT	Sustainability Analyst	Manufacturing	Presentation	2011
21	Presenter AU	Infrastructure Capability Manager	Manufacturing	Presentation	2011
22	Presenter AV	Project Manager Energy Efficiency	Manufacturing	Presentation	2011
23	Presenter AW	Group and Risk Sustainability Manager	*Multi-sector	Presentation	2011
24	Presenter AX	Senior Consultant	Transport	Presentation	2011
25	Presenter AY	Senior Consultant	Manufacturing	Presentation	2011
26	Presenter AZ	Senior Environmental Advisor	Manufacturing	Presentation	2011
27	Presenter	Sustainability	*Multi-sector	Presentation	2011

	Code	Job title	Sector	Involvement	Year
	BA	Manager,			
28	Presenter BB	Energy Champion	Manufacturing	Presentation	2011
29	Presenter BC	Superintendent Ene rgy	Mining	Presentation	2011
30	Presenter BD	Energy Coordinator	Mining	Presentation	2011
31	Presenter BE	Product Manager	Mining	Presentation	2011
32	Presenter BF	Senior Consultant	Mining	Presentation	2011
33	Presenter BG	Senior Consultant	Mining	Presentation	2011
34	Presenter BH	Energy and Carbon Manager	Commercial	Presentation	2012
35	Presenter BI	Greenhouse and Energy Advisor	Mining	Presentation	2012
36	Presenter BJ	Chief Engineer	Manufacturing	Presentation	2012
37	Presenter BK	Strategic Projects Manager	Mining	Presentation	2012
38	Presenter BL	Manager Sustainability	Commercial	Presentation	2012
39	Presenter BM	Greenhouse and Energy Advisor	Manufacturing	Presentation	2012
40	Presenter BN	Carbon Policy Manager	Electricity generation	Presentation	2012
41	Presenter BO	Energy Analyst	Manufacturing	Presentation	2012
42	Presenter BP	Group Sustainability Manager	Manufacturing	Presentation	2012

	Code	Job title	Sector	Involvement	Year
43	Presenter BQ	Senior Environmental Specialist	Transport	Presentation	2012
44	Presenter BR	Energy Manager	Utilities	Presentation	2012
45	Presenter BS	Climate Change Manager	Multi sector	Presentation	2012
46	Presenter BT	Sustainability Manager	Commercial	Presentation	2012
47	Presenter BU	General Manager Sustainability	Commercial	Presentation	2012
48	Presenter BV	Manager Resource Efficiency and Climate Change	Manufacturing	Presentation	2012
49	Presenter BW	Environmental Advisor	Commercial	Presentation	2012
50	Presenter BX	Environmental Programs Manager	Transport	Presentation	2012
51	Presenter BY	Senior Environmental Advisor	Manufacturing	Presentation	2012
52	Presenter BZ	Environmental Systems Manager	Manufacturing	Presentation	2012
53	Presenter CA	Environmental Manager	Transport	Presentation	2012
54	Presenter CB	Technical Manager	Manufacturing	Presentation	2012
55	Presenter CC	Environment Advisor	Manufacturing	Presentation	2012
56	Presenter CD	Environmental Sustainability Manager	Commercial	Presentation	2012

	Code	Job title	Sector	Involvement	Year
57	Presenter CE	Energy Manager	Mining	Presentation	2012
58	Presenter CF	Energy and Carbon	Manufacturing / resource processing	Presentation	2012
59	Presenter CG	Manager	Manufacturing	Presentation	2012
60	Presenter CH	Manager Environment & Sustainability	Mining	Presentation	2012
61	Presenter CI	Principal Consultant	Mining	Presentation	2012
62	Presenter CJ	Senior Consultant	Mining	Presentation	2012
63	Interviewee CK	Sustainability Manager	Commercial	Interview	2013
64	Interviewee CL	Principal Climate Change and Energy Efficiency	Mining	Interview	2013
65	Interviewee CM	Climate Change and Resource Efficiency Manager	Multi sector	Interview	2013
66	Interviewee CN	Business Development Manager	Transport	Interview	2013
67	Interviewee CO	Environmental Manager	Transport	Interview	2013
68	Interviewee CP	Project Manager Energy Efficiency	Manufacturing	Interview	2013
69	Interviewee CQ	Principal Energy Advisor	Mining	Interview	2013

	Code	Job title	Sector	Involvement	Year
70	Interviewee CR	Principal Energy Efficiency Engineer	Manufacturing	Interview	2013
71	Interviewee CS	Manager Carbon and Energy	Mining	Interview	2013
72	Case CT	Iluka Resources: case study 2011 http://www.ret.gov.au/energy/documents/energyefficiencyopps/res-material/iluka-resources-ltd.pdf	Manufacturing	Archival	2011
73	Case CU	Fortescue Metals Group http://eeo.govspace.gov.au/files/2012/11/Analyses-of-Diesel-Use-for-Mine-Haul-and-Transport-Operations.pdf	Mining	Archival	2011
74	Case CV	Downer EDI Mining Pty Ltd http://eeo.govspace.gov.au/files/2012/11/Analyses-of-Diesel-Use-for-Mine-Haul-and-Transport-Operations.pdf	Mining	Archival	2011
75	Case CW	Leighton Contractors Pty Ltd http://eeo.govspace.gov.au/files/2012/11/Analyses-of-Diesel-Use-for-Mine-Haul-and-Transport-Operations.pdf	Mining	Archival	2011

	Code	Job title	Sector	Involvement	Year
76	Case CX	Thiess Australia's Mining Business Unit: case study 2010 http://eeo.govspace.gov.au/files/2012/11/Thiess-Australian-Mining-Business-Unit.pdf	Mining	Archival	2010
77	Case CY	OneSteel - Newcastle Rod Mill: case study 2010 http://eeo.govspace.gov.au/files/2012/11/OneSteel-Case-Study.pdf	Manufacturing	Archival	2010
78	Case CZ	Nyrstar - Port Pirie Smelter: case study 2009 http://eeo.govspace.gov.au/files/2012/11/Midland-Brick-case-study.pdf	Manufacturing	Archival	2009
79	Case DA	Midland Brick: case study update 2009 http://www.ret.gov.au/energy/Documents/energyefficiencyopps/PDF/Industry%20Case%20Study%20Midland%20Brick%20update.pdf	Manufacturing	Archival	2009
80	Case DB	Incitec Pivot - Gibson Island: case study 2009 http://eeo.govspace.gov	Manufacturing	Archival	2009

	Code	Job title	Sector	Involvement	Year
		.au/files/2012/11/Incitec-Pivot-case-study.pdf			
81	Case DC	Alcoa Pinjarra: case study 2008 http://eeo.govspace.gov.au/files/2012/11/Alcoa-Case-Study.pdf	Manufacturing	Archival	2008
82	Case DD	Xstrata Copper: case study 2007 http://eeo.govspace.gov.au/files/2012/11/Xstrata-Copper.pdf	Manufacturing	Archival	2007
83	Case DE	Orica: case study 2007 http://eeo.govspace.gov.au/files/2012/11/Orica.pdf	Manufacturing	Archival	2007
84	Case DF	Bunker Freight Lines: case study 2008 http://eeo.govspace.gov.au/files/2012/11/Bunker-Freight-Lines-case-study.pdf	Transport	Archival	2008
85	Case DG	Woolworths http://eex.gov.au/case-study/woolworths-evaluating-customer-feedback-on-refrigerated-display-case-doors/	Commercial	Archival	2012
86	Case DH	The GPT Group http://eex.gov.au/case-study/the-gpt-group-energy-performance-contracting-for-	Commercial	Archival	2012

	Code	Job title	Sector	Involvement	Year
		cogeneration-and-energy-efficiency-initiatives-at-530-collins-st-melbourne/			
87	Case DI	Spotless http://eex.gov.au/case-study/spotless-group-approach-to-energy-efficiency/	Commercial	Archival	2012
88	Case DJ	National Australia Bank http://eex.gov.au/case-study/nab/	Commercial	Archival	2012
89	Case DK	Sydney Water http://eex.gov.au/case-study/sydney-water-intermittent-mixing-in-sewage-treatment-plants/	Utility	Archival	2012
90	Case DL	Simplot http://eex.gov.au/case-study/simplot-refrigeration-at-the-bathurst-plant/	Manufacturing	Archival	2012
91	Case DM	Foster's Group http://eex.gov.au/case-study/fosters-group-boiler-upgrade-at-cascade-brewery/	Manufacturing	Archival	2012
92	Case DN	Centennial Coal http://eex.gov.au/case-study/centennial-coal-supporting-project-implementation-through-an-energy-efficiency-fund/	Mining	Archival	2012
93	Case	Downer EDI	Mining	Archival	2012

	Code	Job title	Sector	Involvement	Year
	DO	http://eex.gov.au/case-study/downer-edi-mining-approach-to-energy-efficiency/			
94	Case DP	Newmont Asia Pacific http://eex.gov.au/case-study/newmont-asia-pacific-business-case-and-beyond/	Mining	Archival	2012
95	Case DQ	Rio Tinto Iron Ore http://eex.gov.au/case-study/rio-tinto-iron-ore-investing-in-energy-metering-at-yandicoogina-mine/	Mining	Archival	2012
96	Case DR	Australia Post http://eex.gov.au/case-study/australia-post-approach-to-energy-efficiency/	Transport	Archival	2012
97	Case DS	Linfox http://eex.gov.au/case-study/linfox-eco-driver-training/	Transport	Archival	2012
98	Case DT	Ron Finemore Transport http://eex.gov.au/case-study/ron-finemore-transport-increasing-payload-capacity-on-bulk-tipper-trucks/	Transport	Archival	2012

Glossary

Australian Government Department of Industry, Tourism and Resources (Department of ITR)
The Australian government department responsible for the development and administration of EEBP (1998−2003) and subsequently the EEO legislation until the department was restructured in December 2007.

Australian Government Department of Resources, Energy and Tourism (Department of RET)
The Australian government department responsible for the administration of the EEO legislation from December 2007 until the department was restructured in September 2013 and was renamed the Department of Industry.

Australian Government Department of Industry
The Australian government department responsible for the administration of the EEO legislation from 18 September 2013 until the time of writing.

Collaborative co-creation
The process by which multiple individuals and organisation are involved in experimentation, negotiation and consensus-building with the outcome that previously established institutions are disrupted and new institutions are developed and maintained (Zietsma & McKnight 2009).

Corporate energy practitioner
An individual who:

- has a corporate role in a large energy consuming organisation
- is responsible for improving the overall energy efficiency performance of the organisation
- has visibility and influence across multiple operating sites within their organisation. This might include factories, buildings and mobile fleet (e.g. trucks/cars).

Dynamic

The process through which stakeholders interact to influence energy management practices.

Embeddedness

The degree to which actors and their actions are linked to their social context (Reay, Golden-Biddle & Germann 2006, p. 978).

Energy efficiency

Energy efficiency refers to using less energy to produce the same amount of energy service or useful output (Jollands et al. 2010; Lovins 2004; Patterson 1996; World Energy Council 2008).

Energy efficiency gap

"The difference between the actual level of investment in energy efficiency and the higher level that would be cost beneficial from the consumer's (i.e., the individual's or firm's) point of view" (Brown et al. 2001, p. 1198)

Energy information system

A system that supports the collection, interpretation and reporting of energy data in order to: "measure and maintain performance and to locate opportunities for reducing energy consumption and cost" (Swords, Colyle & Norton 2008, p. 61), and to deliver other business benefits. See Section 3.2.

Energy management

The judicious and effective use of energy to maximise profits and enhance competitive positions through organisational measures and optimisation of energy efficiency in the process (Kannan & Boie 2003, p. 946)
See Section 3.2.

Energy management practices

Activities recognised by a community as the legitimate means of coordinating around energy use in accordance with the goals of an organisation.
See Section 3.2.

Energy management systems (EnMS)

"A set of interrelated or interacting elements to establish an energy policy and energy objectives and processes and procedures to achieve those objectives … The purpose of an energy management system is to enable an organisation to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy use and consumption." (ISO 2011, p. 2)

Energy service company (ESCO)

A company that is engaged in developing, installing and financing comprehensive, performance-based projects, typically 5–10 years in duration, centred around improving the energy efficiency or load reduction of facilities owned or operated by customers (IPMVPC 2002; Vine 2005, p. 691).

Five-year assessment cycle

The EEO legislation requires companies to undertake assessments of all sites over a five-year period (i.e. known as the 'five-year EEO Assessment Cycle').

Institutions

These are: "humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions and codes of conduct), and formal rules (constitutions, laws property rights)" (North 1991, p. 97).

Institutional entrepreneur

A change agent who actively participates in the implementation of changes that diverge from existing institutions (Battilana, Leca & Boxenbaum 2009, p. 70). "The activities of actors who have an interest in particular institutional arrangements and who leverage resources to create new institutions or to transform existing ones" (Maguire, Hardy & Lawrence 2004, p. 657)

Institutional lifecycle

Refers to the process by which institutions are disrupted, recreated and maintained over time.

Institutionalised practices

A social practice that is accepted by a community as a shared routine or recognised form of activity (Zietsma & Lawrence 2010, p. 192).

International Energy Agency

An autonomous intergovernmental organisation established under the framework of the OECD.

Large energy consuming organisation

In this thesis, a large energy consuming organisation is defined as an organisation that meets the threshold of 0.5PJ of energy use per annum, in accordance with the EEO legislation.

NABERS Energy

A performance-based rating scheme that measures the energy efficiency of a building or tenancy.

Stakeholder

"Any group or individual who can affect or is affected by the achievement of the organization's objectives." (Freeman 1984, p. 46)

References

Abdelaziz, E.A., Saidur, R. & Mekhilef, S. 2011, 'A review on energy saving strategies in industrial sector', *Renewable and Sustainable Energy Reviews*, vol. 15, no. 1, pp. 150-68.

AGO 2007, *Energy Efficiency in Government Operations (EEGO)*, The Australian Greenhouse Office (AGO) in the Department of the Environment and Water Resources, Canberra, ACT.

Aguirre, F., Villalobos, J.R., Phelan, P.E. & Pacheco, R. 2011, 'Assessing the relative efficiency of energy use among similar manufacturing industries', *International Journal of Energy Research*, vol. 35, no. 6, pp. 477-88.

Allcott, H. & Greenstone, M. 2012, 'Is There an Energy Efficiency Gap?', *Journal of Economic Perspectives*, vol. 26, no. 1, pp. 3-28.

Allcott, H., Mullainathan, S. & Taubinsky, D. 2012, 'Externalities, internalities, and the targeting of energy policy', *National Bureau of Economic Research Working Paper 17977*.

Allen, R.C. 2009, *The British Industrial Revolution in global perspective*, Cambridge University Press, Cambridge.

Allen, R.C. 2012, 'Backward into the future: The shift to coal and implications for the next energy transition', *Energy Policy*, vol. 50, pp. 17-23.

Alveeson, M. & Sköldberg, K. 2009, *Reflexive Methodology. New Vistas for Qualitative Research*, 2 edn, SAGE, London.

Anderson, S.T. & Newell, R.G. 2004, 'Information programs for technology adoption: the case of energy-efficiency audits', *Resource and Energy Economics*, vol. 26, no. 1, pp. 27-50.

Armenakis, A.A. & Harris, S.G. 2009, 'Reflections: our Journey in Organizational Change Research and Practice', *Journal of Change Management*, vol. 9, no. 2, pp. 127 - 42.

Aten, K., Howard-Grenville, J. & Ventresca, M.J. 2012, 'Organizational Culture and Institutional Theory : A Conversation at the Border', *Journal of Management Inquiry*, vol. 21, no. 1, pp. 78 - 83.

Ates, S.A. & Durakbasa, N.M. 2012, 'Evaluation of corporate energy management practices of energy intensive industries in Turkey', *Energy*, vol. 45, no. 1, pp. 81-91.

Athens, L. 2010, 'Naturalistic Inquiry in Theory and Practice', *Journal of Contemporary Ethnography*, vol. 39, no. 1, pp. 87-125.

Aune, M., Berker, T. & Bye, R. 2009, 'The missing link which was already there: Building operators and energy management in non-residential buildings', *Facilities*, vol. 27, no. 1, pp. 44-55.

Australian Energy Market Commission 2012, 'Power of choice - giving consumers options in the way they use electricity', *http://www.aemc.gov.au/media/docs/Final-report-1b158644-c634-48bf-bb3a-e3f204beda30-0.pdf accessed 10 December 2013*.

Ayres, R., Turton, H. & Casten, T. 2007, 'Energy efficiency, sustainability and economic growth', *Energy*, vol. 32, no. 5, pp. 634-48.

Babb, S. 2006, 'A Sociologist Among Economists: Some Thoughts on Methods, Positionality and Subjectivity', in T. Conner & E. Bliss-Moreau (eds)Sage, Thousand Oaks, California, pp. 43-53.

Babbie, E.R. 2013, *The Practice of Social Research*, Wadsworth Cengage Learning, Belmont, California.
Backlund, S., Thollander, P., Palm, J. & Ottosson, M. 2012, 'Extending the energy efficiency gap', *Energy Policy*, vol. 51, pp. 392-6.
Balogun, J. & Hailey, V.H. 2004, *Exploring Strategic Change, 2nd Ed*, Prentice Hall, London.
Bamford, D.R. & Forrester, P.L. 2003, 'Managing planned and emergent change within an operations management environment', *International Journal of Operations & Production Management*, vol. 23, no. 5, pp. 546–64.
Barker, T., Ekins, P. & Foxon, T. 2007, 'The macro-economic rebound effect and the UK economy', *Energy Policy*, vol. 35, no. 10, pp. 4935-46.
Barla, P. & Proost, S. 2012, 'Energy efficiency policy in a non-cooperative world', *Energy Economics*, vol. 34, no. 6, pp. 2209-15.
Barley, S.R. & Tolbert, P.S. 1997, 'Institutionalization and Structuration: Studying the Links between Action and Institution', *Organization Studies*, vol. 18, no. 1, pp. 93 - 117.
Baron, J.N., Dobbin, F.R. & Jennings, P.D. 1986, 'War and peace: The evolution of modern personnel administration in US industry', *American Journal of Sociology*, vol. 92, no. 2, pp. 350 - 83.
Battilana, J. 2006, 'Agency and Institutions: The Enabling Role of Individuals' Social Position', *Organization*, vol. 16, no. 5, pp. 653 - 76.
Battilana, J. & D'Aunno, T. 2009, 'Institutional work and the paradox of embedded agency', in T.B. Lawrence, R. Suddaby & B. Leca (eds), *Institutional Work. Actors and Agency in Institutional Studies of Organizations.*, Cambridge., pp. 31 - 58.
Battilana, J., Leca, B. & Boxenbaum, E. 2009, 'How Actors Change Institutions: Towards a Theory of Institutional Entrepreneurship', *The Academy of Management Annals*, vol. 3, no. 1, pp. 65 - 107.
Bauer, R., Eichholtz, P. & Kok, N. 2010, 'Corporate Governance and Performance: The REIT Effect', *Real Estate Economics*, vol. 38, no. 1, pp. 1-29.
Bazerman, M. 2008, 'Barriers to Acting in Time on Energy and Strategies for Overcoming Them.', *Harvard Business School Working Paper, 09-063*.
Bazerman, M.H. 1983, 'Negotiator Judgment: A Critical Look at the Rationality Assumption', *American Behavioral Scientist*, vol. 27, no. 2, pp. 211-28.
Becker, M.C. 2004, 'Organizational routines: a review of the literature', *Industrial and Corporate Change*, vol. 13, no. 4, pp. 643 - 77.
Bell, E. & Bryman, A. 2007, 'The Ethics of Management Research: An Exploratory Content Analysis', *British Journal of Management*, vol. 18, no. 1, pp. 63-77.
Benders, J., Berg, R.-J.V.D. & Bijsterveld, M.V. 1998, 'Hitch-hiking on a hype: Dutch consultants engineering re-engineering', *Journal of Organizational Change Management*, vol. 11, no. 3, pp. 201 - 15.
Benn, S., Brown, P., Brown, D., Crittenden, P. & Krithinakis, A. 2011, *Leadership & Change for Energy Efficiency in Accounting & Management: Training Needs Analysis*, NSW Office of Environment & Heritage.
Benn, S., Edwards, M. & Angus-Leppan, T. 2013, 'Organizational Learning and the Sustainability Community of Practice: The Role of Boundary Objects', *Organisation & Environment*, vol. 26, no. 2, pp. 184-202.
Benn, S. & Rusinko, C. 2013, 'Boundary objects, HRM tools and change for sustainability', in M. McIntosh (ed.), *The necessary transition: the journey towards the sustainable enterprise economy*, Sheffield Greenleaf Publishing.

Benson, J.K. 1977, 'Organizations: A Dialectical View', *Administrative Science Quarterly*, vol. 22, no. 1, pp. 1-21.
Berger, P.L. & Luckmann, T. 1966, *The Social Construction of Reality*, Doubleday & Company, New York.
Bernstein, L., Roy, J., Delhotal, K.C., Harnisch, J., Matsuhashi, R., Price, L., Tanaka, K., Worrell, E., Yamba, F. & Fengqi, Z. 2007, 'Industry', in B. Metz, O.R. Davidson, P.R. Bosch, R. Dave & L.A. Meyer (eds), *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
Bertoldi, P., Labanca, N., Rezessy, S., Steuwer, S. & Oikonomou, V. 2013, 'Where to place the saving obligation: Energy end-users or suppliers?', *Energy Policy*.
Bertoldi, P., Rezessy, S., Lees, E., Baudry, P., Jeandel, A. & Labanca, N. 2010, 'Energy supplier obligations and white certificate schemes: Comparative analysis of experiences in the European Union', *Energy Policy*, vol. 38, no. 3, pp. 1455-69.
Besseris, G.J. 2010, 'Design of experiments and environmental improvement: Applying a six sigma toolset', *Environmental Quality Management*, vol. 20, no. 2, pp. 67-78.
Bhattacharyya, S.C. 2010, 'Shaping a sustainable energy future for India: Management challenges', *Energy Policy*, vol. 38, no. 8, pp. 4173-85.
Biggart, N.W. & Lutzenhiser, L. 2007, 'Economic Sociology and the Social Problem of Energy Inefficiency', *American Behavioral Scientist*, vol. 50, no. 8, pp. 1070 - 87.
Bjørner, T.B. & Jensen, H.H. 2002, 'Energy taxes, voluntary agreements and investment subsidies—a micro-panel analysis of the effect on Danish industrial companies' energy demand', *Resource and Energy Economics*, vol. 24, no. 3, pp. 229-49.
Blumstein, C., Krieg, B., Schipper, L. & York, C. 1980, 'Overcoming social and institutional barriers to energy conservation', *Energy*, vol. 5, pp. 355-71.
Bor, Y.J. 2008, 'Consistent multi-level energy efficiency indicators and their policy implications ', *Energy Economics*, vol. 30, no. 5, pp. 2401-19.
Bordass, B. & Leaman, A. 2005, 'Making feedback and post-occupancy evaluation routine 1: A portfolio of feedback techniques', *Building Research & Information*, vol. 33, no. 4, pp. 347-52.
Bordass, W. & Leaman, A. 1997, 'Design for manageability', *Building Research & Information*, vol. 25, no. 3, pp. 148-57.
Botzem, S. & Quack, S. 2006, 'Contested rules and shifting boundaries: International standard setting in accounting.', in M. Djelic & K. Sahlin-Andersson (eds), *Transnational governance: Institutional dynamics of regulation.* , Cambridge University Press, Cambridge, pp. 266 - 86.
Boyd, G.A. & Pang, J.X. 2000, 'Estimating the linkage between energy efficiency and productivity', *Energy Policy*, vol. 28, no. 5, pp. 289-96.
Brady, J.E. & Allen, T.T. 2006, 'Six Sigma Literature: A Review and Agenda for Future Research', *Quality and Reliability Engineering International*, vol. 22, no. 3, pp. 335 - 67.
Brennan, T. 2013, 'Energy Efficiency Policy Puzzles', *The Energy Journal*, vol. 34, no. 2.

Brennan, T.J. 2010, 'Optimal energy efficiency policies and regulatory demand-side management tests: How well do they match?', *Energy Policy*, vol. 38, no. 8, pp. 3874-85.
Breukers, S.C., Heiskanen, E., Brohmann, B., Mourik, R.M. & Feenstra, C.F.J. 2011, 'Connecting research to practice to improve energy demand-side management (DSM) ', *Energy*, vol. 36, no. 4, pp. 2176-85.
Brown, J.S. & Duguid, P. 2001, 'Knowledge and Organization: A Social-Practice Perspective', *Organization Science*, vol. 12, no. 2, pp. 198 - 213.
Brown, M.A. 2001, 'Market failures and barriers as a basis for clean energy policies', *Energy Policy*, vol. 29, no. 14, pp. 1197 - 207.
Brown, M.A., Levine, M.D., Short, W. & Koomey, J.G. 2001, 'Scenarios for a clean energy future', *Energy Policy*, vol. 29, no. 14, pp. 1179 - 96.
Buckingham, L., Dupont, J.-F., Stieger, J., Blain, B. & Brits, C. 2011, 'Improving energy efficiency in Barrick grinding circuits', paper presented to the *Fifth International Cnference on Autogenous and Semiautogenous Grinding Technology (SAG 2011) http://eeo.govspace.gov.au/files/2013/07/Improving-Energy-Efficiency-in-Barrick-Grinding-Circuits.pdf accessed 10 Dec 2013*.
By, R.T. 2005, 'Organisational change management: A critical review', *Journal of Change Management*, vol. 5, no. 4, pp. 369 - 80.
Bye, T. & Bruvoll, A. 2008, 'Multiple instruments to change energy behaviour: The emperor's new clothes?', *Energy Efficiency*, vol. 1, no. 4, pp. 373 - 86.
Cadman, D. 2000, *The vicious circle of blame*, Upstream consulting.
Cagno, E. & Trianni, A. 2013, 'Exploring drivers for energy efficiency within small- and medium-sized enterprises: First evidences from Italian manufacturing enterprises', *Applied Energy*, vol. 104, pp. 276-85.
Campbell, C.J. 2012, 'Recognition of peak oil', *Wiley Interdisciplinary Reviews: Energy and Environment*, vol. 1, no. 1, pp. 114-7.
Carley, S. 2009, 'State renewable energy electricity policies: An empirical evaluation of effectiveness', *Energy Policy*, vol. 37, no. 8, pp. 3071-81.
Cassell, C. 2009, 'Interviews in Organizational Research', in D.A. Buchanan & A. Bryman (eds), *The Sage Handbook of Organizational Research Methods*, SAGE, London, pp. 176 - 95.
CDP 2013, *Linking Climate Engagement to Financial Performance: An Investor's Perspective*, The Carbon Disclosure Project (CDP) and Sustainable Insight Capital Management
Cebon, P.B. 1992, ''Twixt cup and lip. Organisational behaviour, technical prediction and conservation practice', *Energy Policy*, vol. 20, pp. 802-14.
Christoffersen, L.B., Larsen, A. & Togeby, M. 2006, 'Empirical analysis of energy management in Danish industry', *Journal of Cleaner Production*, vol. 14, no. 5, pp. 516-26.
Clark, G.L. & Hebb, T. 2005, '"Why should they care? The role of institutional investors in the market for corporate social responsibility"', *Environment and Planning*, vol. A 37, pp. 2015–31.
Clegg, S. 2010, 'The State, Power, and Agency: Missing in Action in Institutional Theory?', *Journal of Management Inquiry*, vol. 19, no. 1, pp. 4-13.
Climate Change Authority 2012, 'Renewable Energy Target Review: Issues Paper'.
Commonwealth of Australia 2002, *Energy Efficiency Best Practice*.
Commonwealth of Australia 2004, *Securing Australia's Energy Future - Energy White Paper*, Department of Prime Minister and Cabinet, Commonwealth of Australia.

Cooremans, C. 2011, 'Make it strategic! Financial investment logic is not enough', *Energy Efficiency*, vol. 4, no. 4, pp. 473 - 92.
Cooremans, C. 2012, 'Investment in energy efficiency: do the characteristics of investments matter?', *Energy Efficiency*, vol. 5, no. 4, pp. 497-518.
Corbett, C.J. & Kirsch, D.A. 2001, 'International diffusion of ISO 14000 certification', *Production & Operations Management*, vol. 10, no. 3, pp. 327-42.
Costa, A., Keane, M.M., Raftery, P. & O'Donnell, J. 2012, 'Key factors methodology—A novel support to the decision making process of the building energy manager in defining optimal operation strategies', *Energy and Buildings*, vol. 49, pp. 158-63.
Côté, R., Booth, A. & Louis, B. 2006, 'Eco-efficiency and SMEs in Nova Scotia, Canada', *Journal of Cleaner Production*, vol. 14, no. 6-7, pp. 542-50.
Crittenden, P. 2003, *Dairy Processing Case Study - Murray Goulburn Co-operative, Rochester Branch*, Australian Department of Industry, Science and Resources.
Crittenden, P., Benn, S. & Dunphy, D. 2011, 'Learning and Change for Sustainability at Yarra Valley Water', in S. Benn, D. Dunphy & B. Perrot (eds), *Cases in Corporate Sustainability*, Tilde University Press, Sydney, pp. 147-61.
Crittenden, P. & Lewis, H. 2011, 'Accelerating the uptake of energy efficiency in industry - a case study of the Australian Energy Efficiency Opportunities program', paper presented to the *Energy efficiency first: The foundation of a low-carbon society, European Council for an Energy Efficient Economy 2011 Summer Study*, Belambra Presqu'île de Giens, France.
Crittenden, P. & Lewis, H. 2012, 'Influencing financial decisions on energy efficiency: six key strategies to build management support', paper presented to the *American Council for an Energy-Efficient Economy Summer Study on Energy Efficiency in Buildings*, Pacific Grove, California, USA.
Croucher, M. 2011a, 'Are energy efficiency standards within the electricity sector a form of regulatory capture? ', *Energy Policy*, vol. 39, no. 6, pp. 3602-4.
Croucher, M. 2011b, 'Potential problems and limitations of energy conservation and energy efficiency', *Energy Policy*, vol. 39, no. 10, pp. 5795 - 9.
Croucher, M. 2012, 'Energy efficiency: Is re-distribution worth the gains? ', *Energy Policy*, vol. 45, pp. 304 - 7.
Czarniawska, B. 2009, 'Emerging Institutions: Pyramids or Anthills?', *Organization Studies*, vol. 30, no. 4, pp. 423 - 41.
Dacin, M.T., Goodstein, J. & Scott, W.R. 2002, 'Institutional theory and institutional change: Introduction to the special research forum', *Academy of Management Journal*, vol. 45, no. 1, pp. 45 - 57.
David, R.J. & Bitektine, A.B. 2009, 'The Deinstitutionalization of Institutional Theory? Exploring Divergent Agendas in Institutional Research', in D.A. Buchanan & A. Bryman (eds), *The Sage Handbook of Organizational Research Methods*, SAGE, London, pp. 176 - 95.
David, R.J. & Strang, D. 2006, 'When fashion is fleeting: transitory collective beliefs and the dynamics of TQM consulting', *Academy of Management Journal*, vol. 49, no. 2, pp. 215 - 33.
Dawson, P. 1997, 'In at the deep end: Conducting processual research on organisational change', *Scandinavian Journal of Management*, vol. 13, no. 4, pp. 389 - 405.
Dawson, P. 2003, *Reshaping Change: A processual perspective*, Routledge, London.

Dawson, P. 2005, 'Changing manufacturing practices: An appraisal of the processual approach', *Human Factors and Ergonomics in Manufacturing*, vol. 15, no. 4, pp. 385-402.
de Almeida, A.T., Fonseca, P. & Bertoldi, P. 2003, 'Energy-efficient motor systems in the industrial and in the services sectors in the European Union: characterisation, potentials, barriers and policies', *Energy*, vol. 28, no. 7, pp. 673-90.
DeCanio, S.J. 1993, 'Barriers within firms to energy-efficient investments', *Energy Policy*, vol. 21, no. 9 pp. 906–14.
DeCanio, S.J. 1998, 'The efficiency paradox: bureacratic and organizational barriers to profitable energy-saving investments', *Energy Policy*, vol. 26, no. 5, pp. 441 - 54.
DeCanio, S.J. & Watkins, W.E. 1998, 'Investment in energy efficiency: do the characteristics of firms matter?', *Review of Economics & Statistics*, vol. 80, no. 1, pp. 95 - 107.
Delmas, M.A. & Montes-Sancho, M.J. 2011, 'U.S. state policies for renewable energy: Context and effectiveness', *Energy Policy*, vol. 39, no. 5, pp. 2273-88.
Denis, J.L., Langley, A. & Cazale, L. 1996, 'Leadership and Strategic Change under Ambiguity', *Organization Studies*, vol. 17, no. 4, pp. 673-99.
Department of Industry 2013, *Energy Efficiency Opportunities Program. The first five years: 2006-11*, The Australian Government Department of Industry.
Dilling, L. & Farhar, B. 2007, 'Making it easy: establishing energy efficiency and renewable energy as routine best practice', *Creating a Climate for Change Communicating Climate Change and Facilitating Social Change*, Cambridge University Press.
DiMaggio, P.J. 1988, 'Interest and agency in institutional theory', in L. Zucker (ed.), *Institutional patterns and culture*, Ballinger Publishing Company, Cambridge, MA, pp. 3-22.
DiMaggio, P.J. & Powell, W.W. 1983, 'The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields', *American Sociological Review*, vol. 48, no. 2, pp. 147 - 60.
DiMaggio, P.J. & Powell, W.W. 1991, 'Introduction', in W.W. Powell & P.J. DiMaggio (eds), *The New Institutionalism in Organizational Analysis*, University of Chicago Press., Chicago, pp. 183–203.
Dixon, R.K., McGowan, E., Onysko, G. & Scheer, R.M. 2010, 'US energy conservation and efficiency policies: Challenges and opportunities', *Energy Policy*, vol. 38, no. 11, pp. 6398-408.
Dixon, T., Keeping, M. & Roberts, C. 2008, 'Facing the future: energy performance certificates and commercial property', *Journal of Property Investment & Finance* vol. 26, no. 1, pp. 96 - 100.
Dorado, S. 2005, 'Institutional Entrepreneurship, Partaking, and Convening', *Organization Studies*, vol. 26, no. 3, pp. 385 - 414.
Dunphy, D., Griffiths, A. & Benn, S. 2007, *Organisational Change for Corporate Sustainability*, Routledge, London.
Dunstan, C., Ross, K. & Ghiotto, N. 2011, 'Barriers to Demand Management: A Survey of Stakeholder Perceptions', *Prepared for the Australian Alliance to Save Energy by the Institute for Sustainable Futures, University of Technology, Sydney.*
Duplessis, B., Adnot, J., Dupont, M. & Racapé, F. 2012, 'An empirical typology of

energy services based on a well-developed market: France', *Energy Policy*, vol. 45, pp. 268 - 76.

Eichholtz, P., Kok, N. & Yonder, E. 2012, 'Portfolio greenness and the financial performance of REITs', *Journal of International Money and Finance*, vol. 31, no. 7, pp. 1911-29.

Eisenhardt, K. 1989, 'Building Theories from Case Study Research', *Academy of Management Review*, vol. 14, no. 4, pp. 532 - 50.

Eisenhardt, K.M. & Graebner, M.E. 2007, 'Theory building from cases: opportunities and challenges', *Academy of Management Journal*, vol. 50, no. 1, pp. 25 - 32.

Emirbayer, M. & Mische, A. 1998, 'What is agency?', *American Journal of Sociology*, vol. 103, no. 4, pp. 962 - 1023.

Enkvist, P.-A., Naucler, T. & Rosander, J. 2007, 'A cost curve for greenhouse gas reduction', *The McKinsey Quarterly*, vol. 1, no. February, pp. 35-45.

Ernedal, S. & Gombosuren, E. 2011, 'On a path towards an energy efficiency policy framework - the case of Mongolia', paper presented to the *Energy efficiency first: The foundation of a low-carbon society, European Council for an Energy Efficient Economy 2011 Summer Study*, Belambra Presqu'île de Giens, France.

Eyre, N. 1997, 'External costs. What do they mean for energy policy?', *Energy Policy*, vol. 25, no. 1, pp. 85-95.

Fairhurst, G.T. & Sarr, R.A. 1996, *The art of framing: Managing the language of leadership. San Francisco: Jossey-Bass.*, Jossey-Bass., San Francisco.

Feldman, M.S. 2003, 'A performative perspective on stability and change in organizational routines', *Industrial and Corporate Change*, vol. 12, pp. 727-52.

Ferreira, V., Alves, L., Basañez-Unanue, G., González, M.I., NikosTourlis, Pasinetti, R., Siciliano, A. & Kenny, P. 2008, 'Lessons learned from the implementation of metering and monitoring systems in public buildings in Europe – ENERinTOWN project 379', *5th International Conference on Improving Energy Efficiency in Commercial Buildings: IEECB Focus 2008*, eds P. Bertoldi & B. Atanasiu, pp. 379-88.

Fischer, C. & Newell, R.G. 2008, 'Environmental and technology policies for climate mitigation', *Journal of Environmental Economics and Management*, vol. 55, no. 2, pp. 142-62.

Fleiter, T., Schleich, J. & Ravivanpong, P. 2012, 'Adoption of energy-efficiency measures in SMEs—An empirical analysis based on energy audit data from Germany', *Energy Policy*, vol. 51, pp. 863-75.

Fleiter, T., Worrell, E. & Eichhammer, W. 2011, 'Barriers to energy efficiency in industrial bottom-up energy demand models—A review ', *Renewable and Sustainable Energy Reviews*, vol. 15, no. 6, pp. 3099-111.

Fligstein, N. 1997, 'Social Skill and Institutional Theory', *American Behavioral Scientist*, vol. 40, pp. 397 - 405.

Fligstein, N. 2001, 'Social skill and the theory of fields', *Sociological theory*, vol. 19, no. 2, pp. 105-25.

Fligstein, N. & McAdam, D. 2011, 'Toward a General Theory of Strategic Action Fields', *Sociological Theory*, vol. 29, no. 1, pp. 1-26.

Flyvbjerg, B. 2006, 'Five Misunderstandings About Case-Study Research', *Qualitative Inquiry*, vol. 12, no. 2, pp. 219-45.

Fontana, A. & Frey, J.H. 2008, 'The interview: From Neutral Stance to Political Involvement', in N.K. Denzin & Y.S. Lincoln (eds), *Collecting and*

Interpreting Qualitative Materials, SAGE, London, pp. 115 - 59.
Foss, N.J. 2003, 'Bounded rationality in the economics of organization: "Much cited and little used"', *Journal of Economic Psychology*, vol. 24, no. 2, pp. 245-64.
Fouquet, R. 2009, 'A brief history of energy', in J. Evans & L.C. Hunt (eds), *International Handbook of the Economics of Energy*, Edward Elgar Publications, Cheltenham, UK, and Northampton, MA, USA.
Fouquet, R. 2010, 'The slow search for solutions: Lessons from historical energy transitions by sector and service', *Energy Policy*, vol. 38, no. 11, pp. 6586-96.
Fouquet, R. 2011, 'Divergences in Long-Run Trends in the Prices of Energy and Energy Services', *Review of Environmental Economics and Policy*, vol. 5, no. 2, pp. 196-218.
Fouquet, R. & Pearson, P.J.G. 2012, 'Past and prospective energy transitions: Insights from history', *Energy Policy*, vol. 50, pp. 1-7.
Freeman, R.E. 1984, *Strategic Management: A Stakeholder Approach*, Pitman, Boston.
Friedland, R. & Alford, R.R. 1991, 'Bringing society back in: symbols, practices and institutional contradictions.', in W.W. Powell & P.J. DiMaggio (eds), *The new Institutionalism in Organizational Analysis*, University of Chicago Press., Chicago, pp. 232-63.
Gale, F. 2004, 'The consultation dilemma in private regulatory regimes: negotiating FSC regional standards in the United States and Canada', *Journal of Environmental Policy & Planning*, vol. 6, no. 1, pp. 673 - 99.
Garcia, A.G.P., Szklo, A.S., Schaeffer, R. & McNeil, M.A. 2007, 'Energy-efficiency standards for electric motors in Brazilian industry', *Energy Policy*, vol. 35, no. 6, pp. 3424-39.
Garnaut, R. 2008, *The Garnaut Climate Change Review: Final Report*, Cambridge University Press.
Garud, R. 2008, 'Conferences as Venues for the Configuration of Emerging Organizational Fields: The Case of Cochlear Implants', *Journal of Management Studies*, vol. 45, no. 6, pp. 1061–88.
Garud, R., Hardy, C. & Maguire, S. 2007, 'Institutional Entrepreneurship as Embedded Agency: An Introduction to the Special Issue', *Organization Studies*, vol. 28, no. 7, pp. 957 - 69.
Garud, R. & Karnoe, P. 2004, 'Distributed Agency and Interactive Emergence', in S.W. Floyd, J. Roos, C.D. Jacobs & F.W. Kellermanns (eds), *Innovating Strategy Processes*, Blackwell Publishing, Maldan, MA
Garud, R. & Karnøe, P. 2003, 'Bricolage versus breakthrough: distributed and embedded agency in technology entrepreneurship', *Research Policy*, vol. 32, no. 2, pp. 277 - 300.
Geels, F.W. 2004, 'From sectoral systems of innovation to socio-technical systems. Insights about dynamics and change from sociology and institutional theory', *Research Policy*, vol. 33, pp. 897 - 920.
Geels, F.W., Hekkert, M.P. & Jacobsson, S. 2008, 'The dynamics of sustainable innovation journeys', *Technology Analysis & Strategic Management*, vol. 20, no. 5, pp. 521-36.
Giacone, E., Mancò, S. & Gabriele, P. 2008, 'Energy Management Techniques for Small- and Medium-Sized Companies (ESDA2006-95808)', *Journal of Energy Resources Technology*, vol. 130, no. 1.
Gillingham, K. & Palmer, K. 2013, *Bridging the Energy Efficiency Gap: Insights for Policy from Economic Theory and Empirical Analysis*, Resources for the

Future.
Giroux, H. 2006, ''It was such a handy term': Management fashions and pragmatic ambiguity.', *Journal of Management Studies*, vol. 43, no. 6, pp. 1227-60.
Glanz, J. 2012, 'Power, pollution and the internet', *The New York Times*.
Goldberg, A., Holdaway, E., Reinaud, J. & O'Keeffe, S. 2012, *Promoting Energy Savings and GHG Mitigation Through Industrial Supply Chain Initiatives*, Institute for Industrial Productivity and ECOFYS.
Goldstein, D.B., McKane, A. & Desai, D. 2011, 'ISO 50001: Energy Management Systems: A Driver for Continual Improvement of Energy Performance', *American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Industry*, Niagara Falls (New York), July 26-29, 2011.
Gowdy, J.M. 2004, 'Altruism, evolution, and welfare economics', *Journal of Economic Behavior & Organization*, vol. 53, no. 1, pp. 69-73.
Graetz, F. 2000, 'Strategic change leadership', *Management Decision*, vol. 38, no. 8, pp. 550-62.
Granderson, J., Piette, M.A. & Ghatikar, G. 2010, 'Building energy information systems: user case studies', *Energy Efficiency*, vol. 3, no. 4.
Greening, L.A., Greene, D.L. & Difiglio, C. 2000, 'Energy efficiency and consumption - the rebound effect - a survey', *Energy Policy*, vol. 28, no. 6-7, pp. 389-401.
Greening, L.A. & Jefferson, M. 2013, 'Energy policy: The flip side', *Energy Policy*, vol. 61, pp. 1-2.
Greenwood, R. & Hinings, C.R. 1996, 'Understanding Radical Organizational Change: Bringing together the Old and the New Institutionalism', *The Academy of Management Review*, vol. 21, no. 4, pp. 1022-54.
Greenwood, R., Oliver, C., Sahlin, K. & Suddaby, R. 2008, 'Introduction', in R. Greenwood, C. Oliver, R. Suddaby & K. Sahlin (eds), *The SAGE handbook of Organizational Institutionalism*, Sage, London.
Greenwood, R. & Suddaby, R. 2006, 'Institutional entrepreneurship in mature fields: the big five accounting firms', *Academy of Management Journal*, vol. 49, no. 1, pp. 27 - 48.
Greenwood, R., Suddaby, R. & Hinings, C.R. 2002, 'Theorizing change: the role of professional associations in the transformation of institutionalized fields', *Academy of Management Journal*, vol. 45, no. 1, pp. 58 - 80.
GRESB Foundation 2011, 'Global Real Estate Sustainability Benchmark Research Report 2011'.
GRESB Foundation 2012, 'Global Real Estate Sustainability Benchmark Research Report 2012'.
Grünewald, P.H., Cockerill, T.T., Contestabile, M. & Pearson, P.J.G. 2012, 'The socio-technical transition of distributed electricity storage into future networks—System value and stakeholder views', *Energy Policy*, vol. 50, pp. 449-57.
Gullberg, A.T. 2008, 'Lobbying friends and foes in climate policy: The case of business and environmental interest groups in the European Union', *Energy Policy*, vol. 36, no. 8, pp. 2964-72.
Gynther, L., Mikkonen, I. & Smits, A. 2011, 'Evaluation of European energy behavioural change programmes', *Energy Efficiency*.
Hamilton, I. & Eriksson, J. 2011, 'Influence strategies in shareholder engagement: a case study of all Swedish national pension funds', *Journal of Sustainable*

Finance & Investment, vol. 1, no. 1, pp. 44-61.
Hamilton, J.D. 2011, *Historical oil shocks*, MA National Bureau of Economic Research, Cambridge, MA.
Hancock, D. & Algozzine, B. 2006, *Doing Case Study Research: A Practical Guide for Beginning Researchers*, Teachers College Press, New York.
Hardy, C. & Maguire, S. 2008, 'Institutional entrepreneurship', in R. Greenwood, C.Oliver, R. Suddaby & K. Shalin-Anderson (eds), *Handbook of organizational institutionalism*, Sage, Thousand Oaks, CA, pp. 198–217.
Hargrave, T.J. & Van De Ven, A.H. 2006, 'A collective action model of institutional innovation', *Academy of Management Review*, vol. 31, no. 4, pp. 684 - 888.
Hargrave, T.J. & Van De Ven, A.H. 2009, 'Institutional work as the creative embrace of contradiction', in T.B. Lawrence, R. Suddaby & B. Leca (eds), *Institutional Work. Actors and Agency in Institutional Studies of Organizations.*, Cambridge.
Harris, J., Anderson, J. & Shafron, W. 2000, 'Investment in energy efficiency: a survey of Australian firms', *Energy Policy*, vol. 28, no. 12, pp. 867-76.
Harrison, D. & Seiler, M. 2011, 'The political economy of green office buildings', *Journal of Property Investment & Finance* vol. 29, no. 4/5, pp. 551 - 65.
Hasanbeigi, A., Menke, C. & Pont, P. 2009, 'Barriers to energy efficiency improvement and decision-making behavior in Thai industry', *Energy Efficiency*, vol. 3, no. 1, pp. 33-52.
Hawken, P., Lovins, H. & Lovins, L.H. 1999, *Natural capitalism: Creating the next industrial revolution.*, Little, Brown., Boston.
He, J., Liu, B. & Zhang, A. 2006, 'Analysis of the effect and potential of energy conservation in China', *Energy Policy*, vol. 34, no. 18, pp. 3702-8.
Helcke, G.A., Conti, F., Daniotti, B. & Peckham, R.J. 1990, 'A Detailed Comparison of Energy Audits Carried Out by Four Separate Companies on the Same Set of Buildings', *Energy and Buildings*, vol. 14, no. 2, pp. 153-64.
Hinnells, M., Bright, S., Langley, A., Woodford, L., Schiellerup, P. & Bosteels, T. 2008, 'The greening of commercial leases', *Journal of Property Investment & Finance*, vol. 26, no. 6, pp. 541 - 51.
Hirst, E. & Brown, M. 1990, 'Closing the efficiency gap: barriers to the efficient use of energy', *Resources, Conservation and Recycling*, vol. 3, pp. 267 - 81.
Hoffman, A. 1999, 'Institutional evolution and change: Environmentalism and the U.S. chemical industry', *Academy of Management Journal*, vol. 42, no. 4, pp. 351-71.
Hoffman, A. & Bazerman, M. 2007, 'Changing practice on sustainability: Understanding and overcoming the organizational and psychological barriers to action', in M.S.a.B.H. S. Sharma (ed.), *Organizations and the Sustainability Mosaic: New Perspectives in Research on Corporate Sustainability*, Northampton, MA: Edward Elgar.
Hoffman, A.J. 2001, 'Linking Organizational and Field-Level Analyses: The Diffusion of Corporate Environmental Practice', *Organization Environment*, vol. 14, no. 2, pp. 133-56.
Hoffman, A.J. & Henn, R. 2008, 'Overcoming the Social and Psychological Barriers to Green Building', *Organization Environment*, vol. 21, no. 4, pp. 390-419.
Hoffman, A.J. & Woody, J.G. 2008, *Climate Change: What's Your Business Strategy?*, Harvard Business Press Boston, Massachusetts.
Holm, P. 1995, 'The dynamics of institutionalization: Transformation processes in Norwegian fisheries.', *Administrative Science Quarterly*, vol. 40, no. 3, pp.

398 - 422.
Honma, S. & Hu, J.-L. 2009, 'Total-factor energy productivity growth of regions in Japan', *Energy Policy*, vol. 37, no. 10, pp. 3941-50.
Horowitz, M.J. 2001, 'Economic Indicators of Market Transformation: Energy Efficient Lighting and EPA's Green Lights', *The Energy Journal*, vol. 22, no. 4, pp. 95-122.
Howard-Grenville, J.A. & Hoffman, A.J. 2003, 'The importance of cultural framing to the success of social initiatives in business', *Academy of Management Executive*, vol. 17, no. 2.
Huberman, A.M. & Miles, M.B. 2002, *The Qualitative Researcher's Companion*, SAGE, Thousand Oaks, California.
Hwang, H. & Colyvas, H.A. 2011, 'Problematizing Actors and Institutions in Institutional Work', *Journal of Management Inquiry*, vol. 20, no. 1, pp. 62-6.
IEA 2000, *Energy Labels and Standards.* , OECD/International Energy Agency (IEA), Paris.
IEA 2003, 'Creating Markets for Energy Technologies', *International Energy Agency (IEA), OECD/IEA, Paris.*
IEA 2007, *Mind the Gap: Quantifying principal-agent problems in energy efficiency*, International Energy Agency (IEA), Paris.
IEA 2010a, 'Energy performance certification of buildings', *International Energy Agency (IEA), OECD/IEA, Paris.*
IEA 2010b, 'Improving compliance within equipment energy efficiency programs', *International Energy Agency (IEA), OECD/IEA, Paris.*
IEA 2011, 'World Energy Outlook ', *International Energy Agency (IEA), OECD/IEA, Paris.*
IEA 2012, *World Energy Outlook* International Energy Agency (IEA), Paris.
IEA 2013, *Redrawing the Energy-Climate Map*, International Energy Agency (IEA), OECD/IEA, Paris.
IMF 2013, *Energy subsidy reform: lessons and implications*.
IPCC 2001, *Climate Change 2001 Working Group III: Mitigation*, Intergovernmental Panel on Climate Change. United Nations Enviornment Program/ World Meteorological Organisation. Cambridge University Press, Cambridge UK.
IPCC 2007, *Climate Change 2007: Mitigation of climate change.*, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) , B.Metz, O.R.Davidson, P.R. Bosch, R. Dave and L.A. Meyer (eds), Cambridge University Press, Cambridge and New York.
IPMVPC 2002, *International Performance Measurement & Verification Protocol. Concepts and options for determining energy and water savings.*, International Performance Measurement & Verification Protocol Committee (IPMVPC).
ISO 2011, *ISO 50001 Energy management systems - Requirements with guidance for use*, International Organization for Standardization (ISO), Geneva.
Iwaro, J. & Mwasha, A. 2010, 'A review of building energy regulation and policy for energy conservation in developing countries', *Energy Policy*, vol. 38, no. 12, pp. 7744-55.
Jaffe, A.B. & Stavins, R.N. 1994a, 'The energy-efficiency gap. What does it mean?', *Energy Policy*, vol. 22, no. 10, pp. 804 - 10.
Jaffe, A.B. & Stavins, R.N. 1994b, 'The energy paradox and the diffusion of

conservation technology', *Resource and Energy Economics*, vol. 16, no. 2, pp. 91-122.
Jamasb, T. & Pollitt, M. 2008, 'Security of supply and regulation of energy networks', *Energy Policy*, vol. 36, no. 12, pp. 4584-9.
Janda, K.B. & Parag, Y. 2013, 'A middle-out approach for improving energy performance in buildings', *Building Research & Information*, vol. 41, no. 1, pp. 39-50.
Jean-Sébastien, B., Patrice, N., Paul, B., Bernard, B. & Jérôme, A. 2008, 'Can energy savings from actions promoting energy efficient behaviours in office buildings be accounted for? A French case study ', *5th International Conference on Improving Energy Efficiency in Commercial Buildings: IEECB Focus 2008*, eds P. Bertoldi & B. Atanasiu, pp. 379-88.
Jelic, D., Gordic, D., Babic, M., Koncalovic, D. & Sustersic, V. 2010, 'Review of existing energy management standards and possibilities for its introduction in Serbia', *Thermal Science*, vol. 14, no. 3, pp. 613-23.
Jollands, N. 2009, *Energy Efficiency at the IEA*, 5 November 2009.
Jollands, N. & Patterson, M. 2004, 'Four theoretical issues and a funeral: improving the policy-guiding value of eco-efficiency indicators.', *International Journal of Environment and Sustainable Development 3, 235– 261.*, vol. 3, no. 3/4, pp. 235– 61.
Jollands, N., Waide, P., Ellis, M., Onoda, T., Laustsen, J., Tanaka, K., T'Serclaes, P.d., Barnsley, I., Bradley, R. & Meier, A. 2010, 'The 25 IEA energy efficiency policy recommendations to the G8 Gleneagles Plan of Action', *Energy Policy*, vol. 38, no. 11, pp. 6409 - 18.
Kannan, R. & Boie, W. 2003, 'Energy management practices in SME - case study of a bakery in Germany', *Energy conversion and management*, vol. 44, pp. 945-59.
Kanter, R.M., Stein, B.A. & Jick, T.D. 1992, *The Challenge of Organizational Change* The Free Press, New York.
Kawamoto, K., Shimoda, Y. & Mizuno, M. 2004, 'Energy saving potential of office equipment power management', *Energy and Buildings*, vol. 36, no. 9, pp. 915-23.
Ke, J., Price, L., McNeil, M., Khanna, N.Z. & Zhou, N. 2013, 'Analysis and practices of energy benchmarking for industry from the perspective of systems engineering', *Energy*, vol. 54, pp. 32-44.
King, N. 2004, 'Using Interviews in Qualitative Research', in C.M. Cassell & G. Symon (eds), *Essential Guide to Qualitative Methods in Organizational Research*, SAGE, London, pp. 11-22.
Klok, J., Larsen, A., Dahl, A. & Hansen, K. 2006, 'Ecological Tax Reform in Denmark: history and social acceptability', *Energy Policy*, vol. 34, no. 8, pp. 905-16.
Kong, L., Price, L., Hasanbeigi, A., Liu, H. & Li, J. 2012, 'Potential for reducing paper mill energy use and carbon dioxide emissions through plant-wide energy audits: A case study in China', *Applied Energy*.
Könnölä, T. & Unruh, G.C. 2007, 'Really changing the course: the limitations of environmental management systems for innovation', *Business Strategy and the Environment*, vol. 16, no. 8, pp. 525-37.
Kotter, J.P. 1996, *Leading Change*, vol. March-April 1995, Harvard Business School Press, Boston, MA.
Kounetas, K., Mourtos, I. & Tsekouras, K. 2012, 'Is energy intensity important for

the productivity growth of EET adopters?', *Energy Economics*, vol. 34, no. 4, pp. 930-41.
Kounetas, K., Skuras, D. & Tsekouras, K. 2011, 'Promoting energy efficiency policies over the information barrier ', *Information Economics and Policy*, vol. 23, no. 1, pp. 72-84.
Kounetas, K. & Tsekouras, K. 2008, 'The energy efficiency paradox revisited through a partial observability approach', *Energy Economics*, vol. 30, no. 5, pp. 2517-36.
Kraatz, M.S. 2011, 'Two Cheers for Institutional Work', *Journal of Management Inquiry*, vol. 20, no. 1, pp. 59 - 61.
Kraatz, M.S. & Block, E.S. 2008, 'Organizational Implications of Institutional Pluralism', in R. Greenwood, C.Oliver, R. Suddaby & K. Sahlin-Andersson (eds), *The Sage handbook of organizational institutionalism*, Sage, London.
Kuhn, T.S. 1970, *The structure of scientific revolutions*, University of Chicago Press, Chicago.
Lampel, J. & Meyer, A.D. 2008, 'Field-Configuring Events as Structuring Mechanisms: How Conferences, Ceremonies, and Trade Shows Constitute New Technologies, Industries, and Markets', *Journal of Management Studies*, vol. 45, no. 6, pp. 1025 - 35.
Langley, A. 1999, 'Strategies for theorizing from process data', *Academy of Management Review*, vol. 24, no. 4, pp. 691 - 710.
Langley, A. 2009, 'Studying Processes in and Around Organizations', in D.A. Buchanan & A. Bryman (eds), *The Sage Handbook of Organizational Research Methods*, SAGE, London, pp. 409 - 29.
Langley, A. & Tsoukas, H. 2010, 'Introducing "Perspectives on Process Organization Studies"', in T. Hernes & S. Maitlis (eds), *Process, Sensemaking & Organizing*, Oxford University Press, Oxford, pp. 1-26.
Larsen, A., Leth-Petersen, S., Kjærbye, V.H. & Rieper, O. 2006, 'The Effect of Energy Audits in Danish Industry - Evaluation of a DSM Programme', *Energy Studies Review*, vol. 14, no. 2, pp. 30-41.
Larsen, P., Goldman, C., Gilligan, D. & Singer, T.E. 2012, 'Incorporating Non-Energy Benefits into Energy Savings Performance Contracts ', *2012 ACEEE (American Council for an Energy Efficiency Economy) Summer Study on Energy Efficiency in Buildings*, Pacific Grove, California.
Lawrence, T., Suddaby, R. & Leca, B. 2011, 'Institutional Work: Refocusing Institutional Studies of Organization', *Journal of Management Inquiry*, vol. 20, no. 1, pp. 52 - 8.
Lawrence, T.B., Hardy, C. & Phillips, N. 2002, 'Institutional effects of interorganizational collaboration: the emergence of proto-institutions', *Academy of Management Journal*, vol. 45, no. 1, pp. 281-190.
Lawrence, T.B. & Suddaby, R. 2006, 'Institutions and institutional work', in S.R.Clegg, T.B.Lawrence & W.R.Nord (eds), *Handbook of organization studies, 2nd Edition*, Sage, London.
Lawrence, T.B., Suddaby, R. & Leca, B. 2009, 'Introduction: theorizing and studying institutional work', in T.B. Lawrence, R. Suddaby & B. Leca (eds), *Institutional Work: Actors and Agency in Institutional Studies of Organisations*, Cambridge University Press.
Lawrence, T.B., Winn, M.I. & Jennings, P.D. 2001, 'The temporal dynamics of institutionalization', *Academy of Management Review*, vol. 26, no. 4, pp. 624 - 44.

Lawrence, T.M., Watson, R.T., Boudreau, M.-C., Johnsen, K., Perry, J. & Ding, L. 2012, 'A new paradigm for the design and management of building systems', *Energy and Buildings*, vol. 51, pp. 56-63.
Leaman, A. & Bordass, B. 2007, 'Are users more tolerant of 'green' buildings?', *Building Research & Information*, vol. 35, no. 6, pp. 662-73.
Leaton, J., Ranger, N., Ward, B., Sussams, L. & Brown, M. 2013, *Unburnable Carbon 2013: Wasted capital and stranded assets*, The Carbon Tracker Initiative in collaboration with the Grantham Research Institute of Climate Change and the Environment.
Leca, B., Battilana, J. & Boxenbaum, E. 2006, 'Taking stock on institutional entrepreneurship: What do we do? Where do we go?', *Paper for the AOM meeting in 2006*.
Lee, H., Park, T., Kim, B., Kim, K. & Kim, H. 2013, 'A real option-based model for promoting sustainable energy projects under the clean development mechanism', *Energy Policy*, vol. 54, pp. 360-8.
Levine, M., Urge-Vorsatz, D., Blok, K., Geng, L., Harvey, D., Lang, S., Levermore, G., Mehlwana, A.M., Mirasgedis, S., Novikova, A., Rilling, J. & Yoshino, H. 2007, 'Residential and commercial buildings. In: Climate change 2007: mitigation. Contribution of working group III to the fourth assessment report of the intergovernmental panel on climate change. ', in B. Metz, O.R. Davidson, P.R. Bosch, R. Dave & L.A. Meyer (eds), *Fourth assessment report of the intergovernmental panel on climate change.*, Cambridge University Press United Kingdom and New York, NY, USA., Cambridge, pp. 338–446.
Levine, M.D. & Sonnenblick, R. 1994, 'On the assessment of utility demand-side management programs', *Energy Policy*, vol. 22, no. 10, pp. 848-56.
Leviston, Z. & Walker, I. 2011, *Second Annual Survey of Australian Attitudes to Climate Change: Interim Report*, CSIRO.
Lewin, K. 1951, *Field Theory in Social Science*, Harper and Row, London.
Lewis, A., Elmualim, A. & Riley, D. 2011, 'Linking energy and maintenance management for sustainability through three American case studies', *Facilities*, vol. 29, no. 5, pp. 243 - 54.
Lindelof, N. & Morel, A. 2006, 'A field investigation of the intermediate light switching by users', *Energy and Buildings*, vol. 38, no. 7, pp. 790–801.
Lindkvist, C. & Elmualim, A. 2010, 'Innovation in facilities management: from trajectories to ownership', *Facilities*, vol. 28, no. 9, pp. 405-15.
Lo, A.Y. & Spash, C.L. 2012, 'How Green is your scheme? Greenhouse gas control the Australian way', *Energy Policy*, vol. 50, pp. 150-3.
Lopes, M.A.R., Antunes, C.H. & Martins, N. 2012, 'Energy behaviours as promoters of energy efficiency: A 21st century review ', *Renewable and Sustainable Energy Reviews*, vol. 16, no. 6, pp. 4095-104.
Lounsbury, M. & Crumley, E.T. 2007, 'New Practice Creation: An Institutional Perspective on Innovation', *Organization Studies*, vol. 28, pp. 993 - 1012.
Lounsbury, M. & Ventresca, M. 2003, 'The New Structuralism in Organizational Theory', *Organization*, vol. 10, no. 3, pp. 457 - 80.
Lovins, A.B. 1996, 'Negawatts: Twelve transitions, eight improvements, and one distraction', *Energy Policy*, vol. 24, no. 4, pp. 331-44.
Lovins, A.B. 2004, 'Energy Efficiency, Taxonomic Overview', *Encyclopedia of Energy*, vol. 2, Elsevier, pp. 383 - 401.
Lovins, A.B. 2005, 'More profit with Less Carbon', *Scientific American*, no.

September.
Lu, C., Tong, Q. & Liu, X. 2010, 'The impacts of carbon tax and complementary policies on Chinese economy', *Energy Policy*, vol. 38, no. 11, pp. 7278-85.
Lu, H. & Price, L. 2011, 'Industrial Energy Assessments: A Survey of Programs around the World', paper presented to the *American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Industry*, Niagara Falls (New York), July 26-29, 2011.
Luecke, R. 2003, *Managing Change and Transition*, Harvard Business School Press, Boston, MA.
Lund, C., Harvey, B., Crittenden, P. & Dubey, P. 2010, *Report for the Long Term Training Strategy for the Development of Energy Efficiency Assessment Skills*, Report by GHD for the Department of Resources, Energy and Tourism.
Lutzenhiser, L. 1993, 'Social and behavioral aspects of energy use', *Annual review of energy and the environment*, vol. 18, pp. 247-89.
Maguire, S., Hardy, C. & Lawrence, T.B. 2004, 'Institutional entrepreneurship in emerging fields: HIV/AIDS treatment advocacy in Canada', *Academy of Management Journal*, vol. 47, no. 5, pp. 657 - 79.
Mallett, A., Nye, S. & Sorrell, S. 2011, *Policy options to overcome barriers to industrial energy efficiency in developing countries*.
Marans, R.W. & Edelstein, J.Y. 2010, 'The human dimension of energy conservation and sustainability: A case study of the University of Michigan's energy conservation program', *International Journal of Sustainability in Higher Education*, vol. 11, no. 1, pp. 6 - 18.
March, J.G. & Olsen, J.P. 2006, 'The Logic of Appropriateness', in M. Moran, M. Rein & R.E. Goodin (eds), *The Oxford Handbook of Public Policy*, Oxford University Press, USA., pp. 689 - 708.
Marechal, K. & Lazaric, N. 2010, 'Overcoming inertia: insights from evolutionary economics into improved energy and climate policies', *Climate Policy (Earthscan)*, vol. 10, no. 1, pp. 103-19.
Marino, A., Bertoldi, P., Rezessy, S. & Boza-Kiss, B. 2011, 'A snapshot of the European energy service market in 2010 and policy recommendations to foster a further market development', *Energy Policy*, vol. 39, no. 10, pp. 6190-8.
Masoso, O.T. & Grobler, L.J. 2010, 'The dark side of occupants' behaviour on building energy use ', *Energy and Buildings*, vol. 42, no. 2, pp. 173-7.
Matisoff, D.C. 2013, 'Different rays of sunlight: Understanding information disclosure and carbon transparency', *Energy Policy*, vol. 55, pp. 579-92.
McKane, A., Price, L. & Can, S.d.l.R.d. 2007, *Policies for Promoting Industrial Energy Efficiency in Developing Countries and Transition Economies*, Prepared by UNIDO as a background Paper for the UNIDO Side Event on Sustainable Industrial Development on 8 May 2007 at the Commission for Sustainable Development (CSD-15).
McKane, A., Scheihing, P. & Williams, R. 2008, 'Certifying Industrial Energy Efficiency Performance: Aligning Management, Measurement, and Practice to Create Market Value', *Lawrence Berkeley National Laboratory*.
McKane, A., Williams, R., Perry, W. & Li, T. 2008, 'Setting the Standard for Industrial Energy Efficiency', *Lawrence Berkeley National Laboratory*.
Meyer, A.D., Gaba, V. & Colwell, K.A. 2005, 'Organizing Far from Equilibrium: Nonlinear Change in Organizational Fields', *Organization Science*, vol. 16,

no. 5, pp. 456 - 73.
Miles, M.B. & Huberman, A.M. 1994, *Qualitative Data Analysis*, SAGE, Thousand Oaks, California.
Miles, M.B., Huberman, A.M. & Saldaña, J. 2013, *Qualitative Data Analysis: A Methods Sourcebook 3ed*, SAGE, Thousand Oaks.
Miller, E. & Buys, L. 2008, 'Retrofitting commercial office buildings for sustainability: tenants' perspectives', *Journal of Property Investment & Finance*, vol. 26, no. 6, pp. 552 - 61.
Miller, N.G., Pogue, D., Gough, Q.D. & Davis, S.M. 2009, 'Green Buildings and Productivity', *Journal of Sustainable Real Estate*, vol. 1, no. 1, pp. 167-201.
Mills, E. 2003, 'The insurance and risk management industries: new players in the delivery of energy-efficient and renewable energy products and services', *Energy Policy*, vol. 31, no. 12, pp. 1257-72.
Mills, E. 2009, 'A Global Review of Insurance Industry Responses to Climate Change', *Geneva Papers on Risk & Insurance - Issues & Practice*, vol. 34, no. 3, pp. 323-59.
Mills, E. & Rosenfeld, A. 1996, 'Consumer non-energy benefits as a motivation for making energy-efficiency improvements', *Energy*, vol. 21, no. 7-8, pp. 707 - 20.
Mitchell, L. 2009, 'Green Star and NABERS: Learning from the Australian experience with green building rating tools'.
Morsink, K., Hofman, P.S. & Lovett, J.C. 2011, 'Multi-stakeholder partnerships for transfer of environmentally sound technologies', *Energy Policy*, vol. 39, no. 1, pp. 1-5.
Nakicenovic, N. 1995, *Energy Primer*, Intergovernment Panel on Climate Change.
National Research Council 2010, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*, The National Academies Press, Washington, DC.
Nawrocka, D. & Parker, T. 2009, 'Finding the connection: environmental management systems and environmental performance', *Journal of Cleaner Production*, vol. 17, no. 6, pp. 601-7.
Nelson, H.T. 2012, 'Lost opportunities: Modeling commercial building energy code adoption in the United States', *Energy Policy*, vol. 49, pp. 182-91.
Newell, G. 2008, 'The strategic significance of environmental sustainability by Australian-listed property trusts', *Journal of Property Investment & Finance*, vol. 26, no. 6, pp. 522 - 40.
Newell, G., MacFarlane, J. & Kok, N. 2011, *'Building Better Returns'. A study of the Financial Performance of Green Office Buildings in Australia.*, Report for the Australian Property Institute and the Property Funds Association.
Nordhaus, W.D. 2007, 'A Review of the Stern Review on the Economics of Climate Change', *Journal of Economic Literature,*, vol. 45, no. 3, pp. 686-702.
North, D.C. 1990, *Institutions, Institutional Change and Economic Performance*, Cambridge University Press.
North, D.C. 1991, 'Institutions', *Journal of Economic Perspectives*, vol. 5, no. 1.
Norus, J. 1997, 'The Role of Personal and Professional Networks in the Process of Technological Transformation', *American Behavioral Scientist*, vol. 40, no. 4, pp. 514 - 22.
NSW OEH 2013, *NABERS Annual Report 2012-13*, NSW Office of Environment and Heritage, Sydney, Australia.
Olmos, L., Ruester, S. & Liong, S.-J. 2012, 'On the selection of financing

instruments to push the development of new technologies: Application to clean energy technologies', *Energy Policy*, vol. 43, pp. 252-66.
Orsato, R.J., Hond, F.d. & Clegg, S.R. 2002, 'The Political Ecology of Automobile Recycling in Europe', *Organization Studies*, vol. 23, no. 4, pp. 639 - 64.
Oswick, C. & Robertson, M. 2009, 'Boundary Objects Reconsidered: from Bridges and Anchors to Barricades and Mazes', *Journal of Change Management*, vol. 9, no. 2, pp. 179 - 93.
Painuly, J.P., Park, H., Lee, M.K. & Noh, J. 2003, 'Promoting energy efficiency financing and ESCOs in developing countries: mechanisms and barriers', *Journal of Cleaner Production*, vol. 11, no. 6, pp. 659-65.
Painuly, J.P. & Reddy, B.S. 1996, 'Electricity Conservation Programs: Barriers to Their Implementation', *Energy Sources*, vol. 18, no. 3, pp. 257-67.
Palm, J. 2009, 'Placing barriers to industrial energy efficiency in a social context: a discussion of lifestyle categorisation', *Energy Efficiency*, vol. 2, no. 3, pp. 263 - 70.
Palm, J. & Thollander, P. 2010, 'An interdisciplinary perspective on industrial energy efficiency', *Applied Energy*, vol. 87, no. 10, pp. 3255-61.
Palmer, K., Oates, W.E. & Portney, P.R. 1995, 'Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm?', *Journal of Economic Perspectives*, vol. 9, no. 4, pp. 119-32.
Pamminger, F. & Narangala, R. 2009, 'LCA's evolution and integration into sustainable business decisions : a water company's perspective.', paper presented to the *Sixth Australian Conference on Life Cycle Assessment*, Melbourne, Victoria, Australia, 18 February, 2009.
Park, C., Kwon, K.-S., Kim, W.-B., Min, B.-K., Park, S.-J., Sung, I.-H., Yoon, Y.S., Lee, K.-S., Lee, J.-H. & Seok, J. 2009, 'Energy Consumption Reduction Technology in Manufacturing - A Selective Review of Policies, Standards, and Research', *International Journal of Precision Engineering and Manufacturing*, vol. 10, no. 5, pp. 151 - 73.
Paton, B. 2001, 'Efficiency gains within firms under voluntary environmental initiatives', *Journal of Cleaner Production*, vol. 9, pp. 167-78.
Patterson, M.G. 1996, 'What is energy efficiency?: Concepts, indicators and methodological issues', *Energy Policy*, vol. 24, no. 5, pp. 377-90.
Pearson, P.J.G. & Foxon, T.J. 2012, 'A low carbon industrial revolution? Insights and challenges from past technological and economic transformations', *Energy Policy*, vol. 50, pp. 117-27.
Pellegrini-Masini, G. & Leishman, C. 2011, 'The role of corporate reputation and employees' values in the uptake of energy efficiency in office buildings', *Energy Policy*, vol. 39, no. 9, pp. 5409-19.
Pentland, B.T. 1999, 'Building Process Theory with Narrative: From Description to Explanation', *The Academy of Management Review*, vol. 24, no. 4, pp. 711-24.
Pérez-Lombard, L., Ortiz, J., Maestre, I.R. & Coronel, J.F. 2012, 'Constructing HVAC energy efficiency indicators', *Energy and Buildings*, vol. 47, pp. 619 - 29.
Perkmann, M. & Spicer, A. 2008, 'How are management fashions institutionalized? The role of institutional work', *Human Relations*, vol. 61, no. 6, pp. 811 - 44.
Pizer, W.A. & Popp, D. 2008, 'Endogenizing technological change: Matching empirical evidence to modeling needs', *Energy Economics*, vol. 30, no. 6, pp. 2754-70.

Platt, J. 2007, 'Case Study', in W. Outhwaite & S.P. Turner (eds), *The SAGE Handbook of Social Science Methodology*, SAGE, London, pp. 100-18.

Polleta, F. & Jasper, J.M. 2001, 'Collective Identity and Social Movements', *Annual Review of Sociology* vol. 27, pp. 283 - 305.

Popescu, D., Bienert, S., Schützenhofer, C. & Boazu, R. 2012, 'Impact of energy efficiency measures on the economic value of buildings ', *Applied Energy*, vol. 89, no. 1, pp. 454-63.

Popper, K.R. 1972, *Conjectures and refutations: the growth of scientific knowledge*, Routledge and Kegan Paul, London.

Porter, M.E. & Reinhardt, F.L. 2007, 'A Strategic Approach to Climate', *Harvard Business Review*, no. October.

Porter, M.E. & van der Linde, C. 1995, 'Toward a New Conception of the Environment-Competitiveness Relationship', *Journal of Economic Perspectives*, vol. 9, no. 4, pp. 97-118.

Powell, W.W. 2007, 'The New Institutionalism', in S.R. Clegg & J.R. Bailey (eds), *The International Encyclopedia of Organization Studies, Sage Publishers*.

Powell, W.W. & Colyvas, J.A. 2008, 'Microfoundations of Institutional Theory', in R. Greenwood, C. Oliver, R. Suddaby & K. Sahlin (eds), *The SAGE handbook of Organizational Institutionalism*, Sage, London.

Price, L., Galitsky, C., Kramer, K.J. & McKane, A. 2008, *International experience with Key Program Elements of Industrial Energy Efficiency or Greenhouse Gas Emissions Reduction Target-Setting Programs*, Ernest Orlando Lawrence Berkeley National Laboratory.

Price, L., Galitsky, C., Sinton, J., Worrell, E. & Graus, W. 2005, 'Tax and Fiscal Policies for Promotion of Industrial Energy Efficiency: A survey of International Experience', *LBNL Report, Lawrence Berkeley National Laboratory, Berkeley, CA. LBNL-58128.*

Price, L. & Lu, H. 2011, 'Industrial energy auditing and assessments: A survey of programs around the world', *Energy efficiency first: The foundation of a low-carbon society, European Council for an Energy Efficient Economy 2011 Summer Study*, Belambra Presqu'île de Giens, France.

Price, L., Wang, X. & Yun, J. 2010, 'The challenge of reducing energy consumption of the Top-1000 largest industrial enterprises in China', *Energy Policy*, vol. 38, no. 11, pp. 6485-98.

Punch, K.F. 2005, *Introduction to Social Research, Second Edition*, SAGE, Los Angeles.

Radulovic, D., Skok, S. & Kirincic, V. 2010, 'Energy efficiency public lighting management in the cities', *Energy*

Ramesh, T., Prakash, R. & Shukla, K.K. 2010, 'Life cycle energy analysis of buildings: An overview', *Energy and Buildings*, vol. 42, pp. 1592 - 600.

Reay, T., Golden-Biddle, K. & Germann, K. 2006, 'Legitimizing a New Role: Small Wins and Microprocesses of Change', *The Academy of Management Journal*, vol. 49, no. 5, pp. 977 - 98.

Reay, T. & Hinings, C.R. 2009, 'Managing the Rivalry of Competing Institutional Logics', *Organization Studies*, vol. 30, no. 6, pp. 629 - 52.

Reay, T. & Hinings, C.R.B. 2005, 'The recomposition of an Organizational Field: Health Care in Alberta', *Organization Studies*, vol. 26, no. 3, pp. 351 - 84.

Reckwitz, A. 2002, 'Toward a Theory of Social Practices. A Development in Culturalist Theorizing.', *European Journal of Social Theory*, vol. 5, no. 2, pp. 243 - 63.

Reinaud, J., Goldberg, A. & Rozite, V. 2012, 'Energy Management Programmes for Industry: Gaining through saving', *OECD/IEA and IIP, Paris*.
RET 2009, *Energy Efficiency Opportunities Assessment Handbook*, Department of Resources Energy & Tourism (RET), Commonwealth of Australia version 4 April 2009, Canberra.
RET 2011, 'Energy Efficiency Opportunities Industry Guidelines', *Australian Government Department of Resources, Energy & Tourism (RET)*.
RET 2012a, *Continuing Opportunities 2011 - Results of EEO Assessments reported by participating corporations*, Australian Department of Resources, Energy and Tourism (RET), Canberra, ACT.
RET 2012b, *Continuing Opportunities 2011: Results of EEO Assessments reported by participating corporations*, Australian Government Department of Resources, Energy & Tourism (RET).
RET 2012c, *Energy White Paper 2012: Australia's Energy Transformation*, Australian Department of Resources, Energy and Tourism (RET), Canberra, ACT.
Reyna, E., Hiller, J., Riso, C. & Jay, J. 2012, 'The Virtuous Cycle of Organizational Energy Efficiency: A Fresh Approach to Dismantling Barriers ', *2012 ACEEE (American Council for an Energy Efficiency Economy) Summer Study on Energy Efficiency in Buildings*, Pacific Grove, California.
Rietbergen, M.G. & Blok, K. 2010, 'Setting SMART targets for industrial energy use and industrial energy efficiency', *Energy Policy*, vol. 38, no. 8, pp. 4339-54.
Rigby, J. 2005, 'Policy, theory and pragmatism: implementing the UK's Energy Efficiency Best Practice Programme.', *Policy & Politics*, vol. 33, no. 2, pp. 277 - 96.
Robèrt, K.H., Schmidt-Bleek, B., Aloisi de Larderel, J., Basile, G., Jansen, J.L., Kuehr, R., Price Thomas, P., Suzuki, M., Hawken, P. & Wackernagel, M. 2002, 'Strategic sustainable development -- selection, design and synergies of applied tools', *Journal of Cleaner Production*, vol. 10, no. 3, pp. 197-214.
Rogers-Hayden, T., Hatton, F. & Lorenzoni, I. 2011, ''Energy security' and 'climate change': Constructing UK energy discursive realities', *Global Environmental Change*, vol. 21, pp. 134-42.
Rohdin, P. & Thollander, P. 2006, 'Barriers to and driving forces for energy efficiency in the non-energy intensive manufacturing industry in Sweden', *Energy*, vol. 31, no. 12, pp. 1836-44.
Rohdin, P., Thollander, P. & Solding, P. 2007, 'Barriers to and drivers for energy efficiency in the Swedish foundry industry ', *Energy Policy*, vol. 35, no. 1, pp. 672-7.
Rosenow, J. 2012, 'Energy savings obligations in the UK—A history of change', *Energy Policy*, vol. 49, pp. 373-82.
Rothenberg, S. 2007, 'Environmental managers as institutional entrepreneurs: The influene of institutional and technical pressures on waste management', *Journal of Business Research*, vol. 60, pp. 749 - 57.
Rühl, C., Appleby, P., Fennema, J., Naumov, A. & Schaffer, M. 2012, 'Economic development and the demand for energy: A historical perspective on the next 20 years', *Energy Policy*, vol. 50, pp. 109-16.
Russell, C. 2008, 'Simple Payback: The Wrong Tool for Energy Project Analysis?', *Strategic Planning for Energy and the Environment*, vol. 27, no. 4, pp. 47-53.
Ryan, L. & Campbell, N. 2012, *The multiple benefits of energy efficiency improvements*, International Energy Agency (IEA), Paris, France.

Rynes, S.L. 2007, 'Tackling the "great divide" between research production and dissemination in human resource management.', *Academy of Management Journal*, vol. 50, no. 3, pp. 985-6.
Samouilidis, J.E., Berahas, S.A. & Psarras, J.E. 1983, 'Energy conservation: Centralized versus decentralized decision making', *Energy Policy*, vol. 11, no. 4, pp. 302-12.
Sandberg, P. 2003, 'Industrial energy efficiency: the need for investment decision support from a manager perspective', *Energy Policy*, vol. 31, no. 15, pp. 1623-34.
Sanstad, A.H. & Howarth, R.B. 1994, ''Normal' markets, market imperfections and energy efficiency', *Energy Policy*, vol. 22, no. 10, pp. 795 - 886.
Satchwell, A., Cappers, P. & Goldman, C. 2011, 'Carrots and sticks: A comprehensive business model for the successful achievement of energy efficiency resource standards', *Utilities Policy*, vol. 19, no. 4, pp. 218-25.
Sayce, S., Ellison, L. & Parnell, P. 2007, 'Understanding investment drivers for UK sustainable property', *Building Research and Information*, vol. 35, pp. 629-43.
Schein, E.H. 1997, 'The concept of 'client' from a process consultation perspective. A guide for change agents.', *Journal of Organizational Change Management*, vol. 10, no. 3.
Schleich, J. 2004a, 'Do energy audits help reduce barriers to energy efficiency? An empirical analysis for Germany ', *International Journal of Energy Technology and Policy*, vol. 2, no. 3, pp. 226-39.
Schleich, J. 2004b, 'Energy Costs - Why Bother? Barriers to Energy Efficiency in the German Higher Education Sector', in S. Sorrell, E. O'Malley, J. Schleich & S. Scott (eds), *The economics of energy efficiency: barriers to cost-effective investment*, Edward Elgar Publishing Limited, pp. 287 - 316.
Schleich, J. 2009, 'Barriers to energy efficiency: A comparison across the German commercial and services sector', *Ecological Economics*, vol. 68, no. 7, pp. 2150-9.
Schmidt, T.S., Schneider, M., Rogge, K.S., Schuetz, M.J.A. & Hoffmann, V.H. 2012, 'The effects of climate policy on the rate and direction of innovation: A survey of the EU ETS and the electricity sector', *Environmental Innovation and Societal Transitions*, vol. 2, pp. 23-48.
Schneiberg, M. 2007, 'What's on the path? Path dependence, organizational diversity and the problem of institutional change in the US economy, 1900–1950', *Socio-Economic Review*, vol. 5, no. 1, pp. 47-80.
Schneiberg, M. & Clemens, E.S. 2006, 'The Typical Tools for the Job: Research Strategies in Institutional Analysis', *Sociological Theory*, vol. 24, no. 3, pp. 195 - 227.
Schot, J. & Geels, F.W. 2008, 'Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy', *Technology Analysis & Strategic Management*, vol. 20, no. 5, pp. 537-54.
Schultz, M. 2012, 'Relationships Between Culture and Institutions: New Interdependencies in a Global World?', *Journal of Management Inquiry*, vol. 21, no. 1, pp. 102 - 6.
Schultz, M. & Hinings, B. 2012, 'A Comment at the Border Between Institutional and Organizational Culture Theories', *Journal of Management Inquiry*, vol. 21, no. 1, pp. 107 - 8.
Scott, M.J., Roop, J.M., Schultz, R.W., Anderson, D.M. & Cort, K.A. 2008, 'The

impact of DOE building technology energy efficiency programs on U.S. employment, income, and investment', *Energy Economics*, vol. 30, no. 5, pp. 2283-301.
Scott, W.R. 2001, *Institutions and Organizations*, 2nd edn, Sage, Thousand Oaks, CA
Scott, W.R. 2008, *Institutions and Organizations: Ideas and Interests.*, Sage, Thousand Oaks.
Scott, W.R. 2010, 'Reflections: The Past and Future of Research on Institutions and Institutional Change', *Journal of Change Management*, vol. 10, no. 1, pp. 5-21.
Seo, M.-G. & Creed, W.E.D. 2002, 'Institutional contradictions, praxis, and institutional change: A dialectical perspective', *Academy of Management Review*, vol. 27, no. 2, pp. 222-47.
Shen, B., Price, L. & Lu, H. 2012, 'Energy audit practices in China: National and local experiences and issues', *Energy Policy*, vol. 46, pp. 346-58.
Sherwood, D. 2002, *Seeing the Forest for the Trees: A Manager's Guide to Applying Systems Thinking*, Nicholas Brealey Publishing, London, UK.
Shove, E. 1998, 'Gaps, barriers and conceptual chasms: theories of technology transfer and energy in buildings', *Enegy Policy*, vol. 26, no. 15, pp. 1105-12.
Shove, E., Lutzenhiser, L., Guy, S., Hackett, B. & Wilhite, H. 1998, 'Energy and social systems', in S. Rayner & E. Malone (eds), *Human choice and climate change* Battelle, Columbus, OH.
Shove, E., Pantzar, M. & Watson, M. 2012, *The Dynamics of Social Practice: Everyday Life and How it Changes*, SAGE.
Siggelkow, N.V., No. 1, 20–24. 2007, 'Persuasion with case studies', *Academy of Management Journal.*, vol. 50, no. 1, pp. 20-4.
Sillince, J. & Mueller, F. 2007, 'Switching Strategic Perspective: The Reframing of Accounts of Responsibility', *Organization Studies*, vol. 28, no. 2, pp. 155-76.
Simon, H.A. 1959, 'Theories of decision-making in economics and behavioural science', *American Economic Review*, vol. XLIX, no. 3, pp. 258-83.
Simon, H.A. 1979, 'Rational Decision Making in Business Organizations', *The American Economic Review*, vol. 69, no. 4, pp. 493-513.
Sminia, H. 2009, 'Process research in strategy formation: Theory, methodology and relevance', *International Journal of Management Reviews*, vol. 11, no. 1, pp. 97-125.
Smith, A., Stirling, A. & Berkhout, F. 2005, 'The governance of sustainable sociotechnical transitions', *Research Policy*, vol. 34, no. 10, pp. 1491–510.
Sorrell, S. 2004, 'Introduction', in S. Sorrell, E. O'Malley, J. Schleich & S. Scott (eds), *The economics of energy efficiency: barriers to cost-effective investment*, Edward Elgar Publishing Limited, pp. 287 - 316.
Sorrell, S., Mallett, A. & Nye, S. 2011, *Barriers to industrial energy efficiency: A literature review*.
Sorrell, S., O'Malley, E., Schleich, J. & Scott, S. 2004, *The economics of energy efficiency: barriers to cost-effective investment*, Edward Elgar Publishing Limited.
Sorrell, S., Schleich, D.J., Scott, D.S., O'Malley, E., Trace, F., Boede, U., Ostertag, K. & Radgen, D.P. 2000, 'Reducing barriers to energy efficiency in public and private organisations', *Report by Science and Technology Policy Research (SPRU). Brighton, UK.*
Sovacool, B.K. & Brown, M.A. 2010, 'Competing Dimensions of Energy Security:

An International Perspective.', *Annual review of energy and the environment*, vol. 35, no. 1, pp. 77 - 108.
Standards Australia/ Standard New Zealand 2000, 'AS/NZS 3598:2000 Energy audits'.
Star, S.L. & Griesemer, J.R. 1989, 'Institutional Ecology, 'Translations' and Boundary Ojects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39', *Social Studies of Science*, vol. 19, pp. 387 - 420.
Stasinopoulos, P., Smith, M.H., Hargroves, K. & Desha, C. 2009, *Whole System Design: An Integrated Approach to Sustainable Engineering*, Earthscan, London.
Steinberger, J.K., van Niel, J. & Bourg, D. 2009, 'Profiting from negawatts: Reducing absolute consumption and emissions through a performance-based energy economy', *Energy Policy*, vol. 37, no. 1, pp. 361-70.
Steinfeld, J., Bruce, A. & Watt, M. 2011, 'Peak load characteristics of Sydney office buildings and policy recommendations for peak load reduction', *Energy and Buildings*.
Stern, N. 2007, *The Economics of Climate Change: The Stern Review*, Cambridge University Press, Cambridge.
Stern, R.N. & Barley, S.R. 1996, 'Organizations and social systems: Organization theory's neglected mandate.', *Administrative Science Quarterly*, vol. 41, no. 1, pp. 146 - 62.
Stilwell, F. 2002, *Political Economy: The Contest of Economic Ideas*, Oxford University Press, South Melbourne.
Stone, L.J. 2006, 'Limitations of cleaner production programmes as organisational change agents. II. Leadership, support, communication, involvement and programme design', *Journal of Cleaner Production*, vol. 14, no. 1, pp. 15-30.
Strang, D. & Sine, W.D. 2000, 'Inter-Organizational Institutions', *J.A.C. Baum (ed.) Companion to Organizations. Blackwell publishing*.
Suchman, M.C. 1995, 'Managing Legitimacy: Strategic and Institutional Approaches', *Academy of Management Review*, vol. 20, no. 3, pp. 571 - 610.
Suddaby, R. 2010a, 'Challenges for Institutional Theory', *Journal of Management Inquiry*, vol. 19, no. 1, pp. 14-20.
Suddaby, R. 2010b, 'Construct Clarity in Theories of Management and Organisation', *Academy of Management Review*, vol. 35, no. 3, p. 346 57.
Suddaby, R., Elsbach, K.D., Greenwood, R., Meyer, J.W. & Zilber, T.B. 2010, 'Organizations and their institutional environments - bringing meaning, values, and culture back in: Introduction to the special research forum', *Academy of Management Journal*, vol. 53, no. 6, pp. 1234 - 40.
Suddaby, R. & Greenwood, R. 2009, 'Methodological Issues in Researching Institutional Change', in D.A. Buchanan & A. Bryman (eds), *The Sage Handbook of Organizational Research Methods*, SAGE, London, pp. 176 - 95.
Swords, B., Colyle, E. & Norton, B. 2008, 'An enterprise energy-information system', *Applied Energy*, vol. 85, pp. 61-9.
Tanaka, K. 2008, 'Assessing measures of energy efficiency performance and their application in industry', *IEA Information Paper in support of the G8 plan of action*.
Tanaka, K. 2011, 'Review of policies and measures for energy efficiency in industry sector', *Energy Policy*, vol. 39, no. 10, pp. 6532-50.

Taylor, C. 1971, 'Interpretation and the Sciences of Man', *The Review of Metaphysics*, vol. 25, no. 1, pp. 3-51.

Tenbrunsel, A., Wade-Benzoni, K., Messick, D. & Bazerman, M. 1997, 'The dysfunctional effects of standards on environmental attitudes and choices', in M. Bazerman, D. Messick, A. Tenbrunsel & K. Wade-Benzoni (eds), *Psychological perspectives to environmental and ethical issues*, New Lexington Books., San Francisco, pp. 105-21.

Therkelsen, P. & McKane, A. 2013, 'Implementation and rejection of industrial steam system energy efficiency measures', *Energy Policy*, vol. 57, pp. 318-28.

Thollander, P. 2008, 'Towards Increased Energy Efficiency in Swedish Industry: Barriers, Driving Forces & Policies'.

Thollander, P., Backlund, S., Trianni, A. & Cagno, E. 2013, 'Beyond barriers – A case study on driving forces for improved energy efficiency in the foundry industries in Finland, France, Germany, Italy, Poland, Spain, and Sweden', *Applied Energy*, vol. 111, pp. 636-43.

Thollander, P. & Ottosson, M. 2007, 'An energy efficient Swedish pulp and paper industry - exploring barriers to and driving forces for cost-effective energy efficiency investments', *Energy Efficiency*, vol. 1, no. 21 - 34.

Thollander, P. & Ottosson, M. 2010, 'Energy management practices in Swedish energy-intensive industries', *Journal of Cleaner Production*, vol. 18, no. 12, pp. 1125-33.

Thollander, P. & Palm, J. 2013, *Improving Energy Efficiency in Industrial Energy Systems: An Interdisciplinary Perspective on Barriers, Energy Audits, Energy Management, Policies, and Programs*, Springer-Verlag, London.

Thollander, P., Rohdin, P. & Moshfegh, B. 2012, 'On the formation of energy policies towards 2020: Challenges in the Swedish industrial and building sectors', *Energy Policy*, vol. 42, pp. 461-7.

Thornton, P.H. & Ocasio, W. 2008, 'Institutional Logics', in R. Greenwood, C. Oliver, R. Suddaby & K. Sahlin (eds), *The Sage Handbook of Organizational Institutionalism*, Sage, London.

Tolbert, P.S. & Zucker, L.G. 1994, 'Institutional analysis of organizations: Legitimate but not institutionalized', *ISSR Working Paper*, vol. 6, no. 5.

Trianni, A. & Cagno, E. 2012, 'Dealing with barriers to energy efficiency and SMEs: Some empirical evidences ', *Energy*, vol. 37, no. 1, pp. 494-504.

Trianni, A., Cagno, E., Thollander, P. & Backlund, S. 2013, 'Barriers to industrial energy efficiency in foundries: a European comparison', *Journal of Cleaner Production*, vol. 40, pp. 161-76.

Tsai, W.-H., Lin, S.-J., Liu, J.-Y., Lin, W.-R. & Lee, K.-C. 2011, 'Incorporating life cycle assessments into building project decision-making: An energy consumption and CO2 emission perspective', *Energy*.

Tsoukas, H. & Chia, R. 2002, 'On Organizational Becoming: Rethinking Organizational Change', *Organization Science*, vol. 13, no. 5, pp. 567 - 82.

Tuominen, P., Klobut, K., Tolman, A., Adjei, A. & Best-Waldhober, M.d. 2012, 'Energy savings potential in buildings and overcoming market barriers in member states of the European Union', *Energy and Buildings*, vol. 51, pp. 48 - 55.

Tversky, A. & Kahneman, D. 1991, 'Loss Aversion in Riskless Choice: A Reference-Dependent Model', *The Quarterly Journal of Economics*, vol. 106, no. 4, pp. 1039 - 61.

U.S. DOE 1996, *Analysis of energy-efficiency investment decisions by small and medium-sized manufacturers DOE/PO-0043*, United States Department of Energy (DOE) Washington, DC.
U.S. Energy Information Administration 2013a, *How much energy is consumed in the world by each sector?*, http://www.eia.gov/tools/faqs/faq.cfm?id=447&t=1, viewed November 2013.
U.S. Energy Information Administration 2013b, *International Energy Outlook 2013*, U.S. Energy Information Administration (IEA), Washington D.C.
Ürge-Vorsatz, D. & Metz, B. 2009, 'Energy efficiency revisited: how far does it get us in controlling climate change? Editorial for Part II of the Special issue', *Energy Efficiency*, vol. 2, no. 4, pp. 287 - 92.
Ürge-Vorsatz, D. & Novikova, A. 2008, 'Non-residential buildings for combating climate change: Summary of the findings of the Intergovernmental Panel on Climate Change', *5th International Conference on Improving Energy Efficiency in Commercial Buildings: IEECB Focus 2008*, eds P. Bertoldi & B. Atanasiu, pp. 3-19.
Van de Ven, A.H. 2007, *Engaged Scholarship : A Guide for Organizational and Social Research*, Oxford University Press, Cary, NC, USA.
Van de Ven, A.H. 2010, 'Designing process research studies', *from processresearchmethods.org website*.
Van de Ven, A.H. & Poole, M.S. 2005, 'Alternative Approaches for Studying Organizational Change', *Organization Studies*, vol. 26, no. 9, pp. 1377-404.
van Moort, J.P., Tustin, J., Soderbaum, J. & Hassall, K. 2013, *Energy Efficiency Opportunities Program Review*, ACIL Tasman report prepared for the Department of Resources Energy and Tourism.
Verbong, G.P.J. & Geels, F.W. 2010, 'Exploring sustainability transitions in the electricity sector with socio-technical pathways', *Technological Forecasting and Social Change*, vol. 77, no. 8, pp. 1214-21.
Verbruggen, A., Fischedick, M., Moomaw, W., Weir, T., Nadaï, A., Nilsson, L.J., Nyboer, J. & Sathaye, J. 2010, 'Renewable energy costs, potentials, barriers: Conceptual issues', *Energy Policy*, vol. 38, no. 2, pp. 850-61.
Viadiu, F.M., Fa, M.C. & Saizarbitoria, I.H. 2006, 'ISO 9000 and ISO 14000 standards: an international diffusion model', *International Journal of Operations & Production Management*, vol. 26, no. 2, pp. 141 - 65.
Vine, E. 2003, 'Opportunities for promoting energy efficiency in buildings as an air quality compliance approach', *Energy*, vol. 28, no. 4, pp. 319-41.
Vine, E. 2005, 'An international survey of the energy service company (ESCO) industry', *Energy Policy*, vol. 33, no. 5, pp. 691-704.
Vine, E., Mills, E. & Chen, A. 2000, 'Energy-efficiency and renewable energy options for risk management and insurance loss reduction', *Energy*, vol. 25, pp. 131-47.
Vine, E., Prahl, R., Meyers, S. & Turiel, I. 2010, 'An approach for evaluating the market effects of energy efficiency programs', *Energy Efficiency*, vol. 3, pp. 257 -66.
Warren-Myers, G. 2012, 'The value of sustainability in real estate: A review from a valuation perspective', *Journal of Property Investment & Finance*, vol. 30, no. 2, pp. 115 - 44.
Webber, C.A., Roberson, J.A., McWhinney, M.C., Brown, R.E., Pinckard, M.J. & Busch, J.F. 2006, 'After-hours power status of office equipment in the USA ', *Energy*, vol. 31, no. 14, pp. 2823-38.

Weber, L. 1997, 'Some reflections on barriers to the efficient use of energy', *Energy Policy*, vol. 25, no. 10, pp. 833-5.
Weik, E. 2011, 'Institutional Entrepreneurship and Agency', *Journal for the Theory of Social Behaviour*, vol. 41, no. 4, pp. 466 - 81.
Weizsäcker, E.v., Hargroves, K., Smith, M., Desha, C. & Stasinopoulos, P. 2009, *Factor Five - Transforming the Global Economy through 80% Improvements in Resource Productivity*, Earthscan.
Wicks, D. 2001, 'Institutionalized mindsets of invulnerability: Differentiated institutional fields and the antecedents of organizational crisis. ', *Organization Studies*, vol. 22, pp. 659-92.
Wiel, S. & McMahon, J.E. 2003, 'Governments should implement energy-efficiency standards and labels—cautiously', *Energy Policy*, vol. 31, no. 13, pp. 1403-15.
Wilson, C. & Dowlatabadi, H. 2007, 'Models of Decision Making and Residential Energy Use', *Annual Review of Environment & Resources*, vol. 32, pp. 169–203.
Wooten, M. & Hoffman, A.J. 2008, 'Organizational Fields: Past, Present and Future', in R. Greenwood, C.Oliver, R. Suddaby & K. Sahlin-Andersson (eds), *The Sage handbook of organizational institutionalism*, Sage, London.
World Economic Forum 2010, *Energy Vision Update 2010. Towards a More Energy Efficient World.*
World Energy Council 2008, *Energy Efficiency Policies around the World: Review and Evaluation*, World Energy Council, London, UK.
Worrell, E., A.Laitner, J., Ruth, M. & Finman, H. 2003, 'Productivity benefits of industrial energy efficiency measures', *Energy*, vol. 28, no. 11, pp. 1081 - 98.
Worrell, E., Bernstein, L., Roy, J., Price, L. & Harnisch, J. 2009, 'Industrial energy efficiency and climate change mitigation', *Energy Efficiency*, vol. 1, no. 2, pp. 109 - 23.
Yik, F.W.H., Lee, W.L. & Ng, C.K. 2002, 'Building energy efficiency and the remuneration of operation and maintenance personnel', *Facilities*, vol. 20, no. 13/14, pp. 406 - 13.
Yin, H. & Schmeidler, P.J. 2009, 'Why do standardized ISO 14001 environmental management systems lead to heterogeneous environmental outcomes?', *Business Strategy and the Environment*, vol. 18, no. 7, pp. 469 - 86.
Yin, R.K. 2009, *Case Study Research: Design and Methods Fourth Edition*, SAGE, Thousand Oaks, California.
Ylijoki, O.H. 2005, 'Academic nostalgia: A narrative approach to academic work', *Human Relations*, vol. 58, no. 5, pp. 555-76.
Zbaracki, M.J. 1998, 'The Rhetoric and Reality of Total Quality Management', *Administrative Science Quarterly*, vol. 43, no. 3, pp. 602 - 36.
Zeitz, G., Mittal, V. & McAulay, B. 1999, 'Distinguishing Adoption and Entrenchment of Management Practices: A Framework for Analysis', *Organization Studies*, vol. 20, no. 5, pp. 741 - 76.
Zhou, N., Levine, M.D. & Price, L. 2010, 'Overview of current energy-efficiency policies in China', *Energy Policy*, vol. 38, no. 11, pp. 6439 - 52.
Zietsma, C. & Lawrence, T.B. 2010, 'Institutional Work in the Transformation of an Organizational Field: The Interplay of Boundary Work and Practice Work', *Administrative Science Quarterly*, vol. 55, no. 2, pp. 189-221.
Zietsma, C. & McKnight, B. 2009, 'Building the iron cage: institutional creation work in the context of competing proto-institutions', in T.B. Lawrence, R.

Suddaby & B. Leca (eds), *Institutional Work. Actors and Agency in Institutional Studies of Organizations.*, Cambridge.

Zilber, T.B. 2006, 'The work of the symbolic in institutional processes: translations of rational myths in Israeli high tech', *Academy of Management Journal*, vol. 49, no. 2, pp. 281-303.

Zilber, T.B. 2012, 'The Relevance of Institutional Theory for the Study of Organizational Culture', *Journal of Management Inquiry*, vol. 21, no. 1, pp. 88 - 93.