

# Accelerating the uptake of energy efficiency in industry – a case study of the Australian energy efficiency opportunities program

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## Keywords

industrial energy saving, policy-mix, policy-making, energy assessment, behavioural change

## Abstract

The Energy Efficiency Opportunities program requires large energy using firms in Australia to conduct energy efficiency assessments every five years and report publicly on their energy efficiency performance annually.

Analysis of public reports from 199 participating corporations demonstrates the significant energy savings that are possible across a wide spectrum of industrial firms. Energy projects identified and publicly reported by companies (up to December 2009) are projected to deliver an average 8.3 % reduction of the assessed energy use. Approximately half of the identified projects have been implemented so far and if all identified projects are adopted they will contribute a 2.9 % reduction in Australia's total energy end use.

In this paper we analyse the key features of the EEO program and consider how they are intended to influence barriers to the uptake of energy efficiency in firms. To conduct our analysis we draw on economic, organisational and institutional theory to develop an analytical model. This categorises barriers according to the level at which they are most likely to occur, i.e. at the level of an individual decision maker or a project, more widely across the organisation or within the network of institutional stakeholders.

We then consider the results of a recent review of the EEO program by external consultants, which indicates that barriers to the identification and implementation of energy efficiency have been reduced since the start of the EEO program in July 2006. However, a number of persistent barriers are also identi-

fied. These include a lack of energy data, limited access to capital and the challenge of gaining management support and sufficient resources to exploit the full benefits of energy efficiency improvement. We briefly consider how education and training measures and the introduction of a carbon price may act as mutually reinforcing policies to achieve the shared goal of energy efficiency improvement in industry.

## Introduction

There is increasing attention to the unrealised potential of energy efficiency in Australian industry. This is driven by rising energy prices, public debate about the introduction of a carbon price, and legislation including the Energy Efficiency Opportunities program. The approaches adopted by firms to manage energy use can be complex, and there are many variables that influence performance both within and outside the firm. To deal with this complexity, policy development is often based on consideration of the barriers that limit the uptake of energy efficiency in firms. In this paper we aim to contribute to our understanding of barriers to energy efficiency and the policy measures that can influence them, in two ways:

- by developing an analytical model that distinguishes between barriers at different levels of the firm; and
- by using this model to analyse the design and effectiveness of the Energy Efficiency Opportunities program.

We begin with a brief literature review in which we identify emerging perspectives on barriers from organisational and institutional theory. We then introduce and analyse the EEO program from economic, organisational and institutional per-

**Table 1: Three categories of barriers to energy efficiency with examples and selective literature references.**

Category	Examples	Literature
Economic barriers	Risk, imperfect information, hidden costs, access to capital, split incentives and bounded rationality	Jaffe & Stavins 1994 Brown 2001 Sorrel et al 2004 Garnaut 2008
Organisational barriers	Beliefs, social structure, culture, power relations, skills, capital allocation policy and processes, lack of collaboration across structural and professional boundaries	DeCanio 1998 Biggart and Lutzenheiser 2007 Porter & van der Linde 1995 Hatfield-Dodds et al. 2008 Granade 2009 Paton 2000
Institutional and stakeholder influences	Government agencies, energy suppliers, energy service providers, investors, competitors	Hoffman 2001, Lutzenhiser & Biggart 2001

spectives. This analysis is based on the knowledge gained by one of the authors (Crittenden) through his involvement in program development, industry consultation and implementation. Drawing on the findings from a review of the program by external consultants<sup>1</sup>, we discuss persistent barriers to energy efficiency and briefly consider the role of education and training measures and the introduction of a carbon price in helping to overcome them. We conclude with suggestions for further research that can build upon the exploratory nature of our paper.

### Perspectives on barriers to the uptake of energy efficiency in firms

As policy-makers or practitioners involved with industrial energy efficiency we typically share a common frustration. Why is it that energy efficiency projects, even those that make really good financial sense, get rejected by management or put aside for consideration on another day? This question is even more perplexing as we watch the overall business case for energy efficiency become more compelling.

A common approach to understanding why seemingly cost effective energy efficiency projects are not implemented is to consider the barriers that may hold them back. To understand those barriers however, we inevitably make assumptions about how firms operate, including the way in which decisions are made. Orthodox economists look for barriers or failures in the market that impact on decision-making within the firm (Brown 2001). For example, if managers in a firm don't have all the information they need on energy efficiency options, their approximate costs and benefits and how to deploy them, then it is reasonable to assume that they may have difficulty deciding to invest in those projects (Garnaut 2008).

Behavioural economists consider the behaviour of individuals and limitations on their ability to make informed decisions, even in the presence of what appears to be sufficient information. For example, the concept of 'bounded rationality' highlights other constraints that limit decision-making, including insufficient time, attention, resources and ability to effectively

process the available information. In other words, even if decision makers have access to the necessary information, they also need to have the necessary resources, skills and knowledge to make a rational decision. Sorrel et al. (2004) have combined orthodox, transaction cost and behavioural economic perspectives to develop a useful taxonomy of barriers to energy efficiency that includes risk, imperfect information, hidden costs, access to capital, split incentives and bounded rationality.

A broader explanation of potential barriers is offered through organisational and sociological perspectives. In challenging the dominance of economic perspectives in regard to energy policy, Biggart and Lutzenheiser (2007 p. 1076) suggest that organisations are more like 'arenas of conflict and negotiation' than the rational decision making 'machines' that are assumed in economic theory. They highlight the potential influence of beliefs, structure, culture, power relations, and other non-economic considerations that can act as barriers to the uptake of energy efficiency in firms. For example, organisational members and the professional and functional groups that they operate within may place different priority on the importance of energy efficiency, which can influence their acceptance of, level of attention to and effort put into energy efficiency improvement (Paton 2001; Linnenluecke, Russell et al. 2009). This in turn can impact on collaboration across an organisation by reinforcing management and functional boundaries (Paton 2001). Other functions, such as capital allocation processes within a firm may prioritise business expansion and other strategic priorities over efficiency or cost reduction projects (Lutzenhiser and Biggart 2001; Biggart and Lutzenheiser 2007; Granade, Creyts et al. 2009).

A range of stakeholders *external* to the firm may also influence attitudes and responsiveness to issues such as energy efficiency *within* the firm. Institutional theory highlights the role of organisational contexts and the way in which they influence choice and action within the firm (Hoffman 2001). For example:

- The structure of energy markets and the contractual arrangements offered by energy suppliers may create disincentives to action on energy efficiency (Lutzenhiser and Biggart 2001).

1. Environmental Resources Management Australia (ERM) and the Commonwealth Scientific and Industrial research organisation (CSIRO).

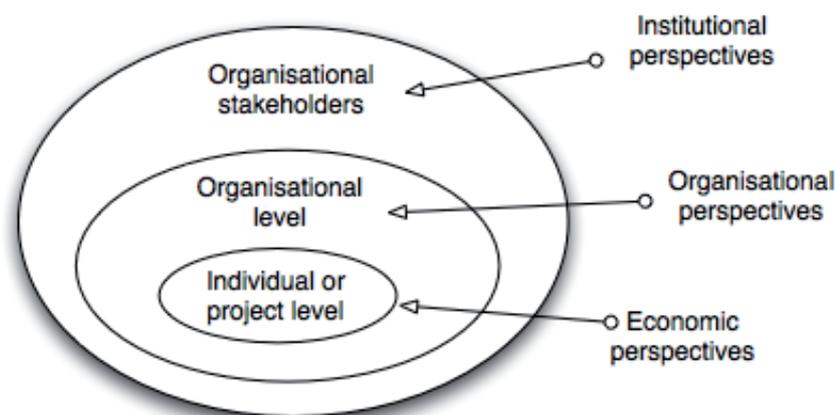


Figure 1: A multi-level analysis of barriers to energy efficiency within firms.

- The lack of suitable products, services, skills and experience in the energy services market may limit the capability of the firm to identify and implement energy efficiency projects.
- A lack of interest from investors, customers and other external stakeholders in a firm's response to energy efficiency may limit the priority placed on energy efficiency improvement within the firm.

In Table 1 we have categorised some of the barriers described in the literature as 'economic', 'organisational' or 'institutional'.

Our purpose in briefly exploring the barriers to the uptake of energy efficiency in firms here is not to provide a complete list. Rather, it is intended to acknowledge the complexity involved in developing policies that are intended to accelerate the uptake of energy efficiency in industrial firms. A key reason for that complexity is that policies need to simultaneously address multiple barriers. It literature also highlights the contribution of different theoretical approaches that can provide unique insights into barriers and the actions required to overcome them. In this paper we attempt to deconstruct the EEO program from each of these three perspectives.

The model we have developed for our analysis is a simplified interpretation of each theoretical perspective to allow this exploratory analysis to be conducted. Economic perspectives tend to describe barriers that occur in regard to the availability of project information and the factors that impact on decisions associated with those projects. Organisational perspectives generally focus on the organisational context in which the decisions are made rather than on specific projects, while the institutional perspective generally considers the role of organisational stakeholders external to the firm. The actions of external stakeholders can influence the organisational context and decisions on individual projects. Our model of analysis (illustrated in Figure 1) considers the level at which barriers are found: the individual decision-maker or project, the organisation, or organisational stakeholders.

One response to the complexity of the barriers to the uptake of energy efficiency is to develop a suite of measures and programs to enhance their efficiency and effectiveness (Lee and Yik 2004). For example, the United States Energy Policy Act of 2005 and Energy Independence and Security Act of 2007 includes voluntary energy efficiency reduction agreements with firms, loan guarantees for innovative new energy

efficiency technologies, grants for research, development and demonstration projects and subsidised workforce training programs (Dixon et al. 2010). In the Top-1000 Energy-Consuming Enterprises program in China, negotiated energy efficiency targets are a central mechanism. Action to achieve those targets are then supported by energy audits, benchmarking, information dissemination and financial incentives (Price et al. 2010)

Ensuring that multiple measures reinforce each other rather than creating additional barriers to action or unnecessary administrative costs presents another significant policymaking challenge. In this paper we build on our analysis of the EEO program by considering the way in which the introduction of a carbon price and education and training strategies may act as mutually reinforcing measures towards a shared goal of achieving energy efficiency improvement in firms.

## The Energy Efficiency Opportunities Program

### BUILDING ON THE LESSONS LEARNT FROM PAST ENERGY EFFICIENCY PROGRAMS

The Energy Efficiency Opportunities program was introduced in 2006. It built on the experience and lessons learnt from a voluntary energy efficiency program, Energy Efficiency Best Practice (EEBP), which was administered by a national government department between 1998 and 2003. The initial aim of EEBP was to influence the uptake of energy efficiency in firms by establishing energy use benchmarks that organisations could use to compare their energy efficiency performance with other firms and best practice. Soon after the commencement of the program however, it became apparent that benchmarking across Australian organisations was severely limited by a lack of quality energy data at both facility and sub-system levels within firms. Industry feedback at the time also highlighted that justifying internal funding to install energy metering equipment and undertake analysis was difficult since the benefits were often not sufficiently known to justify the costs involved. Many firms that did use external service providers to conduct energy audits found significant limitations in the way that traditional audits were being carried out. That is, typically an energy consultant would be commissioned to conduct an energy audit with the goal of establish-

ing a fully costed list of potential energy efficiency projects. However, the consultant was often constrained by the lack of detailed energy data and limited opportunities to engage with personnel within the firm. As a result the reports that were developed often lacked the rigour and detailed business knowledge that was required to inform investment decisions. Since a single manager often commissioned the work and there was little interaction across functional areas, recommendations in audit reports were often not fully considered by decision-makers and limited progress on energy efficiency was achieved.

Two new approaches to energy efficiency assessment were trialled through the EEBP program. The first (called Best Practice People and Processes) involved establishing a site based energy management team that included participants across different functional and professional areas. 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 and discussion the energy management team identified an opportunity to optimise boiler use by improving communications between the boiler operations and shop floor staff. The project was estimated to save approximately AUD\$200,000 (€140,000) per year (ITR 2003). The project did not require funding since it could be implemented through changes to operating practices. However, collaboration across internal operational boundaries was essential.

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 review and analysis of energy data at the site. The report from the data analysis was then reviewed during a two-day workshop with a range of internal staff and external expertise. Stretch goals of more than 40 % energy savings were pursued. Data analysis techniques included examining energy and material flows and benchmarking against theoretical minimum energy use for equipment and processes. A collaborative workshop was held where creativity and innovation were encouraged. Follow up activity involved further evaluation of the opportunities that were identified in the workshop. In one case the firm involved identified savings in the order of 50 % by fundamentally re-designing their plans for a new malting facility. In reviewing this project it was 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 2003).

Evaluation of these programs provided important insights into the potential for energy efficiency improvement in industry and the need for new approaches to overcome the limited outcomes of traditional energy audits. The results and lessons learnt from the EEBP program influenced the design of a new measure, the Energy efficiency Opportunities program which was announced in the Energy White Paper – Securing Australia's Future in June 2004 (Commonwealth of Australia 2004).

## EEO OVERVIEW

The objective of the EEO program is to 'improve the identification and evaluation of energy efficiency opportunities by large energy using businesses and as a result to encourage implementation of cost effective energy efficiency opportunities.' (EEO Act, 2006)

Companies are required to participate in the EEO program when they use more than 0.5PJ of energy in a single financial year. They are then required to conduct energy efficiency assessments to a standard that is outlined in the legislation once every 5 years (the "assessment cycle"). Public reports on the assessment outcomes and business response must be published each year. Implementation of the identified opportunities is at the discretion of the corporation. The assessments and information in public reports are externally verified by the Commonwealth Department of Resources, Energy and Tourism (referred to throughout this paper as "the Department") through desktop reviews and site visits. The program is supported by an information and capacity building program. These key mechanisms are summarised in Table 2.

By the end of October 2010, 283 corporate groups were registered for the program. The number of registered groups has increased in each of the past 5 years as companies trigger the 0.5PJ energy use threshold and/or are informed by the Department of their obligations to register. In 2011 electricity generators will be included in the program for the first time.

Based on the latest public reports that were published by participating corporations prior to December 2009, 82 % of the energy used by Australia's largest 199 energy-using companies had been assessed. The companies reported potential savings that would deliver, on average, an 8.3 % reduction in their total assessed energy use<sup>2</sup>. Of the projects reported, 58 % had a better than 2 year simple payback and 24 % had a simple payback of 2–4 years (Table 3). If all of these projects were to be adopted they would achieve a 2.9 % reduction in Australia's total energy end use. At the time of reporting 54 % of the total identified savings had been adopted by companies. (RET 2010). Most of these companies had not been through external verification at the time of reporting.

Each of the four key mechanisms in the EEO program – energy efficiency assessment, public reporting, external verification and capacity building – are described in more detail in the following section.

## ENERGY EFFICIENCY ASSESSMENT

The EEO Assessment Framework outlines 19 key requirements that corporations must meet in order to demonstrate that they have undertaken an energy efficiency assessment to the standard required under the legislation. The key requirements are organised into six broad categories called key elements. The lessons learnt and experience from the EEBP program informed the initial design of the Assessment Framework. They were then reviewed and further developed with input from experienced industry participants and consultants over an 18-month consultation period. A summary of the key elements is provided in Table 4.

2. Companies must assess a total of 80 % of energy use across the corporate group over the 5 year assessment cycle. For each site at which assessments occur 100 % of the energy use must be assessed.

**Table 2: Four key mechanisms designed to influence the uptake of energy efficiency in firms through their participation in the EEO program.**

Program mechanism	Firm obligations
Energy efficiency assessment	Firms are required to conduct a rigorous and comprehensive assessment of 80% of their total corporate energy use once every 5 years. The EEO Assessment Framework, which is included in the regulations, defines the standard for these assessments.
Public reporting	Firms 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 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 workshops are provided to support firms with implementation.

**Table 3: Identified savings by business response and payback period.**

Business response	<2 years (PJ)	2-4 years (PJ)	4+ years (PJ) (voluntarily reported)	All paybacks (PJ)	Percentage of identified energy savings
Under investigation	17.7	9.1	9.5	36.3	32
Adopted*	45.7	10.3	5.5	61.5	54
Not to be implemented	1.9	8.1	5.8	15.9	14
<b>Total identified savings</b>	<b>65.4</b>	<b>27.5</b>	<b>20.9</b>	<b>113.7</b>	<b>100</b>

Reproduced from RET 2010, p10

\* ‘Adopted’ means companies have reported opportunities as ‘implemented’, ‘implementation commenced’ or ‘to be implemented’

**PUBLIC REPORTING**

Participants in the EEO program are required to make information about their assessments accessible to the public through annual reports. Most participants provide them on their corporate websites. A list of participating corporations and a link to their latest reports is also made available on the Department’s website ([www.energyefficiencyopportunities.gov.au](http://www.energyefficiencyopportunities.gov.au)).

The public reports must include information on:

- The amount of energy use assessed to date;
- The number of opportunities identified by the EEO assessment with less than a two and two to four year payback and the associated energy savings;
- A description of three significant opportunities that have been identified; and
- The number, and associated energy savings, of the identified opportunities against each of the following categories:
  - Under investigation;

- To be implemented;
- Implementation commenced;
- Implemented; and/or
- Not to be implemented.

Public reporting is intended to provide a firm’s external stakeholders with transparent information about how energy efficiency is managed within the firm. Since the reporting is required annually, external stakeholders can compare progress over time. Since other large energy using businesses are also reporting the same information stakeholders are able to compare one company with another.

**EXTERNAL VERIFICATION**

The EEO external verification process aims to ensure that registered corporations have undertaken an assessment to the required standard and that the information within reports is true and accurate. There are two main verification processes.

Table 4: Summary of the EEO Assessment Framework.

Key Element	Summary of the key requirements
Leadership	<ul style="list-style-type: none"> <li>Sufficient resources are made available to enable a rigorous and comprehensive assessment to be completed</li> <li>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 operation management to those involved in the assessment.</li> </ul>
People	<p>Personnel with the appropriate level of technical expertise, as well as personnel that influence energy use on a daily basis through operational decisions, are involved in the assessment to:</p> <ul style="list-style-type: none"> <li>broaden the pool of potential opportunities identified by drawing on a range of perspectives and experience</li> <li>improve understanding of the full range of costs, benefits and implementation issues associated with each of the opportunities</li> <li>build ownership and motivation for the implementation of projects across functional and professional boundaries</li> <li>encourage involvement of people in the assessment process who are going to be necessary for the project to be funded.</li> </ul>
Information, data and analysis	<ul style="list-style-type: none"> <li>Business contextual information is considered so that energy efficiency projects can be considered within the context of other business priorities.</li> <li>The accuracy of facility level data must be within <math>\pm 5\%</math> for each fuel type.</li> <li>Energy analysis tools such as an energy mass balance are used to encourage consideration and evaluation of opportunities at different levels of the business, including system-wide, within sub-systems, for individual processes and individual items of equipment. An energy mass balance identifies where energy is used and 'lost'. Companies are asked to think about the theoretical minimum level of energy use rather than industry benchmarks in order to identify areas of unnecessary energy use.</li> <li>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.</li> </ul>
Opportunity identification and evaluation	<ul style="list-style-type: none"> <li>A systematic process that combines 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.</li> <li>The process encourages personnel within the firm to share their ideas openly.</li> <li>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.</li> <li>All opportunities with a potential four-year payback must be evaluated.</li> <li>Detailed investigation is conducted to an accuracy level of <math>\pm 30\%</math>.</li> <li>All quantifiable business costs and benefits must be included in the evaluation of opportunities to provide a more complete evaluation rather than a sole focus on energy related costs and benefits.</li> </ul>
Decision making	<ul style="list-style-type: none"> <li>Managers responsible for investment decisions must review and then determine the business's response to each of the identified opportunities that have been evaluated.</li> <li>Timelines, resources and accountabilities are allocated for projects that are to be adopted or evaluated further.</li> </ul>
Communicating outcomes	<ul style="list-style-type: none"> <li>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.</li> <li>Senior management and the board must review the EEO report each year.</li> <li>The outcomes from the assessment must be communicated by senior managers to those involved in the assessment and across the organisation.</li> </ul>

\*The content in this table is adapted from Schedule 7 of the EEO Regulations.

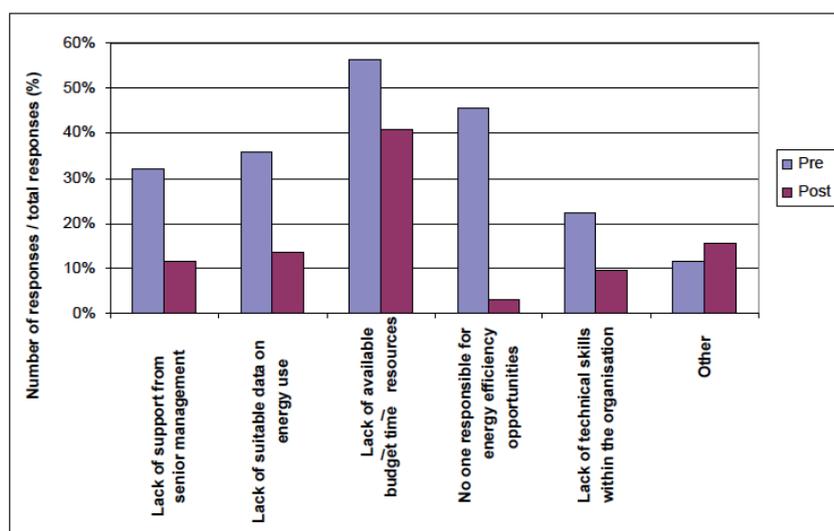


Figure 2: Perceived barriers to the identification of energy efficiency opportunities before and after the start of the EEO (RET 2010) p. 48.

Desktop verification requires participating corporations to complete a checklist and submit information that demonstrates they have undertaken assessments in accordance with the legislation. ‘Full verification’ involves a more detailed review by the Department including site visits. Verification commenced in 2010 and the Department aims for all corporations to undergo deck-top verification in each 5-year assessment cycle with full verification being undertaken by all corporations once every 10 years.

**CAPACITY BUILDING**

The EEO capacity building program provides guidance material, workshops and other resources to help participating corporations meet their obligations under the Act and to maximise the business benefits from their energy efficiency activities. The capacity building program also provides an important opportunity for the Department to develop collaborative relationships with industry personnel and to better understand the challenges they face with implementing the program. Regular contact and feedback from participating corporations to the Department helps to ensure that materials are effectively targeted. The initial focus for the capacity building program was ensuring that participants understand their obligations. As participants have gained experience through implementing the program there is now a stronger emphasis on tailoring initiatives to the specific needs of different industry sub-sectors.

**The mid-cycle review and persistent barriers**

In 2010 an independent review of the EEO program was undertaken by external consultants. This was called the ‘mid-cycle review’ because it was conducted part way through the first 5 year program assessment cycle. The primary objective of the review was to determine the changes to energy-related systems, processes and approaches to energy efficiency that had occurred within participating corporations since the start of the EEO program. The review concluded that significant changes had occurred within participating corporations. This in turn, had improved the effectiveness with which firms identify and evalu-

ate energy efficiency projects which led to greater implementation of energy efficiency projects.

In relation to the Assessment Framework, respondents found that all key elements made an effective contribution to identifying and evaluating energy efficiency projects. The ‘Information Data and Analysis’ element of the framework was considered by respondents to be the most effective key element of the assessment framework. Of interest is that prior to the commencement of the EEO program many firms considered that they would only need to adopt minimal to moderate changes to their data collection and analysis systems and yet the results of the survey suggest that they had made more significant improvements to these systems than any others.

Most program participants reported that the public reports themselves had not generated a high level of interest from external stakeholders. However, the requirement for board review and sign off each year prior to reporting had raised the profile and focus on energy efficiency within many firms since the commencement of the EEO program. There may also be unintended consequences from the requirement to publicly report. Many of those surveyed as part of the review expressed frustration at the overlap with other legislative reporting requirements such as the National Greenhouse and Energy Reporting Act suggesting that the time and resources required to manage the reporting component of the program may be better spent on progressing the identification and implementation of projects.

Although it was not a strong focus of the research conducted as part of the mid-cycle review, two survey questions asked participants were to select from a list of barriers to the identification and the implementation of energy efficiency in their organisations. The list for the survey was developed based on the outcomes from previous surveys that had been undertaken in conjunction with annual EEO workshops. The results are shown in Figure 2 (barriers to identification) and Figure 3 (barriers to implementation).

Overall there was a significant reduction in barriers to the identification of opportunities from before the commencement of the EEO program (pre) and the time of the mid-cycle review (post). The most frequently selected barriers that remained at the time of the review were:

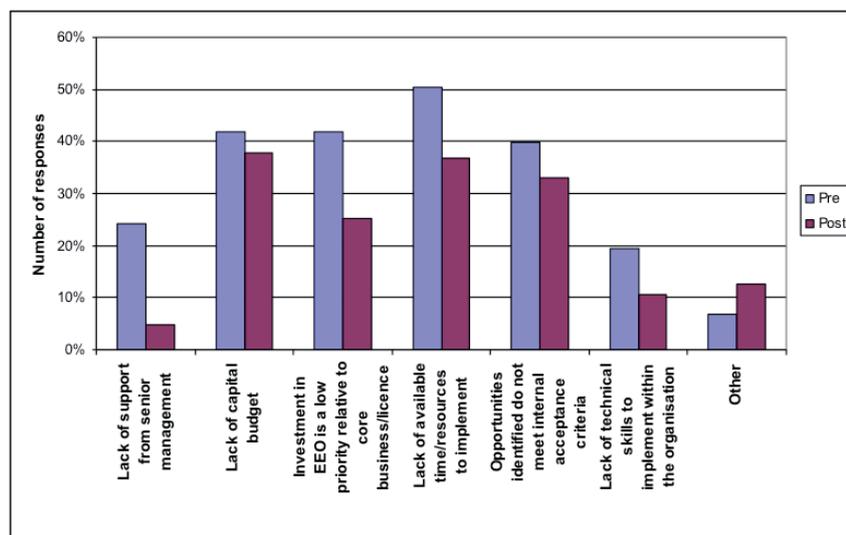


Figure 3: Perceived barriers to implementation of energy efficiency before and after the EEO program (RET 2010) p. 49.

- available budget, time and resources;
- lack of suitable data on energy use; and
- lack of support from senior management.

There was also an overall reduction in barriers to the implementation of opportunities, although changes were not as significant as shown for barriers to the identification of opportunities.

The most frequently selected barriers to the implementation of opportunities at the time of the mid-cycle review were:

- lack of available time/ resources to implement
- lack of capital budget; and
- opportunities identified do not meet internal acceptance criteria

Although we are limited by the way in which the questions were framed and the analysis of results available in the mid-term review report, we can make some tentative observations about these barriers in terms of their impact at project, organisational and institutional levels:

- At the project level a lack of suitable data and insufficient budget and resourcing constraints to fully identify and evaluate opportunities is likely to limit the quality of information available to decision-makers.
- At the organisational level a lack of support from senior management may, in turn impact on budget and resourcing for the identification and implementation of opportunities.

There may also be institutional barriers. For example, the surveys for the mid-cycle review were conducted during the global financial crisis and a number of respondents highlighted the difficulty to access capital for all types of projects including those identified through their EEO assessments.

In the next section we discuss barriers to energy efficiency further and consider the role that other policy measures might play in order to mutually reinforce the mechanisms in the EEO program to influence these persistent barriers.

## Discussion

The four EEO program mechanisms each play an important role in achieving the program outcomes. In order to better understand how the specific requirements within each of the mechanisms act in a mutually reinforcing way to influence the barriers to energy in firms, we analyse how barriers operate and are addressed at each of the three levels defined in our model.

### INDIVIDUAL AND PROJECT LEVEL BARRIERS

Individual and project level barriers from the economic literature include imperfect information, hidden costs, risk and bounded rationality.

Examples of the requirements in the assessment framework that are designed to influence barriers at this level include:

- The accuracy of facility level data must be within  $\pm 5\%$  for each fuel type.
- A range of data analysis approaches must be applied including energy mass balances or equivalent techniques
- All quantifiable business costs and benefits must be included in the evaluation of opportunities to provide a more complete evaluation rather than a sole focus on energy related costs and benefits.
- All opportunities with a potential four-year payback must be evaluated.
- Managers responsible for investment decisions must review and then determine the business's response to each of the identified opportunities that have been evaluated.

The public reporting further reinforces the need for accurate data and careful decision-making since the results are available to the organisation's stakeholders. Verification plays an important role in ensuring that the standards outlined in the assessment framework are achieved. Capacity building guides and workshops help to further define the standards in terms of their practical application. For example, the Energy Savings Measurement Guide describes how to estimate, measure,

evaluate and track energy efficiency projects. At National EEO workshops held in November 2010, data and analysis was a central topic. Industry leaders presented detailed case studies and group work encouraged peer-to-peer learning between workshop participants.

#### ORGANISATIONAL LEVEL BARRIERS

Organisational barriers can have a wide reaching impact on the effort and attention placed on energy efficiency in the firm. Barriers include a lack of senior management support, limited cooperation across structural and professional boundaries and policies and processes that discourage investment in energy efficiency projects.

Examples of the requirements in the assessment framework that are designed to influence barriers at this level include:

- Senior management support for the assessment must be communicated clearly at the commencement of an assessment and includes clear objectives.
- Personnel with the appropriate level of technical expertise, as well as personnel that influence energy use on a daily basis through operational decisions must be involved in the assessment
- A systematic process that combines the analysis of energy and production data with review and interrogation by a range of personnel must be part of the assessment.
- 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.

Public reporting helps to encourage a continuous improvement rather than episodic approach to energy efficiency. This is particularly important since the assessments at each facility may be spaced up to 5 years apart. Since the information is required to be made public on an annual basis the importance of robust internal information tracking systems for energy efficiency in firms is encouraged including the establishment of quality control systems and protocols. Some organisations, such as the National Australia Bank (NAB 2010) use their public report as a channel to communicate their achievements in energy efficiency to their external stakeholders including how their energy efficiency program relates to broader goals such as delivering on greenhouse gas reduction targets.

Verification will also help maintain a focus on energy efficiency, particularly when companies are directly involved.

The capacity building program has developed some guides and resources that have a specific focus on ways of achieving organisational change for energy efficiency. For example, in the EEO Assessment Handbook there are descriptions of key stakeholders with suggestions for how to obtain their support for energy efficiency.

#### INSTITUTIONAL LEVEL BARRIERS

The EEO program does not specifically target particular stakeholders. However, annual public reporting is intended to provide a firm's external stakeholders with transparent information about how energy efficiency is managed within the firm.

Since the reporting is required annually, external stakeholders can compare progress over time. Some of the ways that external stakeholders may use the information includes:

- Customers may use the information in conjunction with Sustainability reports and other information to consider an organisations commitment and progress on energy efficiency and other sustainability issues.
- Investors may use the information in conjunction with other reports such as those published by the Carbon Disclosure Project to obtain more detailed information on the firms approach to greenhouse gas mitigation through energy efficiency.
- Energy service providers may compare reports to identify relative underperformers for which they may be able to offer particular services.

Further research is required to identify which external stakeholders are using the reports and how they are using them.

The results in the mid-cycle review suggest that the EEO program is effectively addressing many of the barriers that are targeted at each level. However, as the mid-cycle review highlighted, persistent barriers in some firms remain. These include a lack of energy data, limited access to capital and the challenge of gaining management support and sufficient resources to exploit the full benefits of energy efficiency improvement. There are many complementary policies that could support the EEO program. We briefly consider two – education and training and introducing a price on carbon.

#### POTENTIAL FOR COMPLEMENTARY MEASURES

##### Education and training

In 2010, the Australian Government commissioned the development of a National Training Strategy for Energy Efficiency Assessment. The project involved research and analysis to identify the skills required and the current skill gaps in companies implementing the EEO and other assessment programs (Commonwealth of Australia 2010).

One of the most common skill gaps identified was energy data collection and analysis. 'Lack of suitable data' was also one of the most commonly rated barriers to the identification of opportunities in the mid-cycle review. Although the link between the two cannot be clearly made, it does highlight that there is an important role for education and training to address this persistent barrier.

Outcomes from the research also had direct implications at the level of organisational barriers. For example the research highlighted the need for a wide range of skills to conduct energy efficiency assessments effectively. Some of these skills are directly related to the barriers such as a lack of support from senior management and limited budget and resourcing. For example: facilitation and negotiation skills, developing effective communications and engagement plans, developing and presenting a business case for energy efficiency projects that is meaningful to all relevant levels and areas of management.

The skills research also highlighted the need for targeting non-engineering professions and trades such as accountants, HR and communication professionals. Funding has recently been made available under the NSW State Government's

Energy Efficiency Training Program for the development of energy efficiency training for accountants and management professionals. (NSW DECCW 2011). Initiatives such as these will help broaden the level of awareness and support for energy efficiency across organisations.

Although not considered in the research, at the institutional level there is an important role for education and training. For example, if external stakeholders such as investors are going to use the data and information in public reports from companies participating in EEO then they need to understand them. Education and training in these areas can integrate with other emerging sustainability programs.

### Introducing a price on carbon

There is a strong debate in Australia currently about the introduction of a price on carbon and the benefits and limitations of a carbon tax compared to an emissions trading scheme. There are many design features of a scheme that can influence the way it functions and the level of incentive provided for energy efficiency (Schleich, Rogge et al. 2008).

Considered from an economic barriers perspective, a price on carbon has the potential to improve access to capital as energy efficiency projects become more financially attractive.

From an organisational perspective however, it may be the public debate and discussion of business risk and uncertainty that also plays a significant role by building management awareness of energy efficiency.

At an institutional level this is a similar situation. For example, we have seen a rise in investor concern about business risk in organisations. As organisational stakeholders become aware of and concerned and better understand energy efficiency there may then be greater pressure within firms to ensure they are improving their energy efficiency performance.

## Conclusions

Our aim in writing this paper has been to develop an analytical model that distinguishes between barriers at different levels of the firm and to use this model to analyse the design and effectiveness of the Energy Efficiency Opportunities program.

The EEO program is seen to have been effective as shown by the summary of public reports that have been made by corporations involved (Table 3) and the mid-cycle review. Our own analysis shows that part of the contribution to this success is that the program addresses energy efficiency barriers at each of the three levels in our model. That is, the individual and project level, the organisational level and at the level of organisational stakeholders.

In relation to the application of the model itself, it provides a relatively straightforward way of deconstructing complex energy efficiency programs such as EEO. As the authors initially found in attempting to relate specific barriers outlined in the economic literature to the design features of the EEO program, there was a great deal of overlap between each specific barrier and the mechanisms designed to influence them. By using the model to group the EEO requirements according to the level at which they were expected to have direct influence within the firm, we were more easily able to identify the intent of each mechanism and the potential interaction of program requirements within and between the different levels. This approach

encourages a more holistic and integrated consideration of energy efficiency policy and the mechanisms designed to influence barriers to energy efficiency in firms.

Our exploratory analysis in this paper highlights that with further development the model could make a contribution to the analysis of energy efficiency policy. Since energy efficiency policy is ultimately concerned about influencing change within firms, the field of organisational change can provide some useful insights into potential research approaches. For example, Pettigrew et. al (2001) highlight that a key challenge in organisational change research is examining the multiple factors that influence the success of change processes. Processual analysis is one approach that can help achieve these. It involves detailed case study research in which change is studied over time with consideration and analysis of the contextual factors that influence the design of change strategies and perceptions of their success. Research is conducted in an iterative manner with concepts and ideas formulated both from the literature and generated from data-driven induction (Dawson 2003).

The model would be well suited to this type of research. At the individual and project level, a selection of both successful and unsuccessful projects could be reviewed. By interviewing a range of staff that had been involved in the projects important insights may be obtained about the barriers identified and the strategies used to overcome them. A focus on specific projects would also help to differentiate between variables such as the types of projects and the organisational factors that influence them. At the organisational level interviews and surveys with managers across hierarchical and operational boundaries could provide insights into the different types of barriers identified and the effectiveness of initiatives designed to build awareness and support for energy efficiency. Survey data could also highlight the role of external stakeholders as drivers for change. At the institutional level the organisation's stakeholders could be identified and considered for the extent to which they act as drivers for improvement and/or as barriers to change.

Research of this type can contribute towards improvement of the model which could be applied to policy design, analysis and evaluation. Approaches such as these can help to further enhance our understanding of the barriers to energy efficiency in firms and the policy measures that can most effectively influence them.

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### Acknowledgements

The authors would like to thank Louise Vickery, General Manager Industrial Energy Efficiency Branch, Department of Resources Energy and Tourism (DRET) for her input to the paper. The views expressed in the paper are those of the authors and not the Department of Resources Energy and Tourism.