

Improving Industrial Energy Efficiency: how Australia is addressing barriers to change among the country's largest energy users

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ABSTRACT

The Australian Government introduced the Energy Efficiency Opportunities program in 2006 to drive change in the way the nation's largest energy users understand, manage and invest in energy efficiency projects. The 280 plus corporations now registered in the program are responsible for 45 per cent of Australia's energy end use and emit 30 per cent of Australia's greenhouse gas emissions. Their energy efficiency performance is critical to improving Australia's energy productivity and reducing its carbon intensity. This paper outlines how Energy Efficiency Opportunities is addressing persistent organisational and information barriers to change within large energy-using companies. It outlines the evaluation strategy for the program and presents the findings of the Phase 1 Early Evaluation, results of the Phase 2 Mid Cycle Review, and the energy efficiency results reported to government by the corporations. The evaluations reveal a marked improvement in the systems and processes that the corporations are using to examine their energy efficiency and show that businesses are identifying and implementing significant energy savings. The paper examines aspects of the program that corporations believe less successful at driving change than expected and discusses areas that were further examined in the Mid Cycle Review to evaluate the success of the program in meeting its goals. The program to date is revealing the substantial energy, financial and carbon abatement benefits that can arise from improving the energy efficiency of large energy users.

Introduction

Industrial energy use makes up a significant and growing proportion of Australia's energy use and energy-related greenhouse gas emissions. As an energy and resource-rich nation, Australia faces major challenges in meeting the growing global demand for energy and resources, while managing its own transformation to a low-carbon economy. The Energy Efficiency Opportunities program was announced by the Australian Government in 2004, with legislation coming into effect in 2006, as part of a package of measures to meet these twin energy and climate change challenges. It was the first national regulatory measure to require the industrial sector to consider the potential for, and report on, its energy use and energy efficiency. Based on Price and Lu (2011), the program appears to be the only mandatory assessment program in the OECD targeting large energy users without providing subsidised audits or tax relief. Australia's goal is to reduce demand for energy and energy infrastructure, and constrain growth in greenhouse gas emissions while enhancing the growth and competitiveness of a highly resource based, export oriented economy.

The potential gains from energy efficiency are clear: it is a low-cost means of reducing energy demand and greenhouse emissions that also offers improvements in business productivity. The IEA predicts that energy efficiency measures could potentially contribute more than 50 per cent of the energy-related emissions reductions needed by 2030 (Tanaka 2009), making accelerated progress in energy efficiency indispensable. In addition, energy efficiency can contribute in the short to medium term while strategies emerge to reduce the carbon intensity of global energy supply.

Energy efficiency has even greater potential in Australia, given its economic structure and energy profile. The 280 plus corporations covered by the Energy Efficiency Opportunities legislation account for 29 per cent of Australia's total energy consumption, as shown in Figure 1, and 62 per cent of the energy consumed by all Australian businesses. These corporations have net energy use exceeding the net energy used for electricity generation in Australia—which is now covered by the program since July 1st 2011. Much of the energy use of these top consumers is by a handful of corporations in the manufacturing and mining sectors. Just 20 of the top energy using corporations use as much energy as all of Australia's households, including household transport. Given their energy use, these corporations are critical to the energy efficiency performance and the future energy demand profile for Australia. For companies, improving energy productivity can deliver significant business benefits including reduced energy and other business costs and lower greenhouse gas emissions, helping them transition to a carbon constrained economy.

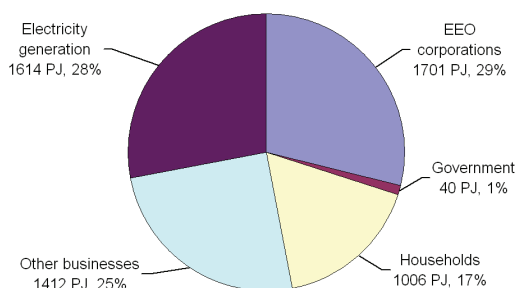


Figure 1. Energy use of EEO corporations relative to other major sectors, 2009-10

This paper outlines how Energy Efficiency Opportunities seeks to improve the energy performance of major energy-using businesses. It examines the persistent barriers that have been impeding energy efficiency improvements and how the program's framework addresses them. Qualitative and quantitative evaluations of program effectiveness were built into the program's design, with three evaluation milestones scheduled through the program's cycle: the Phase 1 Internal Evaluation completed in May 2008; the Phase 2 Mid Cycle Review, an external evaluation completed in December 2010, and the Phase 3 Full Evaluation to be completed in 2012. The first energy assessment results reported by corporations to government in 2008 have also been analysed and published, with the main findings presented here. This paper argues that application of the Energy Efficiency Opportunities program Assessment Framework is helping participating corporations to achieve organisational change while identifying significant energy savings.

Barriers to change and design of the program

Energy Efficiency Opportunities aims to encourage large energy users to better identify and evaluate their cost-effective energy efficiency opportunities so as to encourage greater implementation. Opportunities are projects identified through an assessment that will improve energy usage by producing more for the same energy use, or the same product with reduced energy usage. All businesses that consume more than 0.5 petajoules (PJ) of energy a year are required by legislation to participate in the program (RET 2006). Half a petajoule is equivalent to an electricity bill of \$A6-11 million a year or the energy use of 10,000 Australian households. Corporations must submit an Assessment Plan, undertake a rigorous and comprehensive assessment of their energy efficiency to an improved regulated standard, and report on assessment and their business response, i.e., whether they will implement the opportunities identified. Decisions on whether to proceed with implementation are not mandated: they rest with the business. Participants must report opportunities with payback periods of four years or less, but may voluntarily report projects with longer

paybacks. To encourage greater implementation of energy efficiency projects, corporations are required to report assessment results internally to their board and externally to government and the public.

The program operates on a five-year cycle, with the first running from 2006 to 2011. As of March 2011, over 280 corporations covering more than 1,200 business entities from the manufacturing, mining, transport and services sectors have registered with the program. The first tranche of 199 corporations that registered in 2005-06 have completed their assessments and reported to government and the public at the end of 2008, 2009 and 2010. A verification program started in early 2010; involving desk-top risk assessments of 100 corporations annually, followed by 20 site verifications a year of both randomly selected corporations and those at higher risk of non-compliance. The verification assesses whether businesses have met the key requirements of the Assessment Framework and reported accurately on their findings and business response.

The department undertook extensive industry consultations to identify factors underpinning effective energy assessments, and successful project implementation. Feedback showed that energy was *important*, but not *urgent* for all but the most energy-intensive businesses. Many corporations focused resources and capital on growing their business, not on managing energy. Energy was often poorly understood and considered low priority, particularly during high growth periods. Consultations highlighted barriers to energy efficiency implementation, including poor energy data and information within companies, limited staff and consultant energy analysis knowledge and skills, and energy's low priority for leadership and senior management.

Thollander and Ottosson (2007) categorise barriers to industrial energy efficiency as either market-related—such as bounded rationality or split incentives—or behavioural and organisational, such as energy being a second tier investment priority, lack of staff awareness and long decision chains. Similarly, Cooremans (2011) found that strategic importance is the primary driver of investment, and energy efficiency is often not considered core business, as Rhodin et al. (2011) also observed for Swedish foundries. In Australia, barriers to change combined to keep energy off the company agenda and restrict project implementation, while data collection limitations made it difficult to establish business cases for improved energy efficiency, so projects were unlikely to be implemented or even presented to decision makers. Narrow audit approaches led to perceptions of energy efficiency as an equipment performance improvement process, rather than as a means to improve broader system efficiency and overall business performance. Industry feedback and experience with business energy efficiency programs highlighted that Energy Efficiency Opportunities needed to tackle energy efficiency as an information and organisational challenge requiring capacity building and cultural change as much as mandated energy management. Put simply, the program needed to fundamental change the way large energy users understood and managed their energy. Petersson et al. (2011) found that energy reviews and management systems helped to raise the profile of energy efficiency in Swedish companies and ease access to capital, partly by moderating project risks.

The program's Assessment Framework was subsequently developed to address these barriers and change the way corporations approached energy efficiency. The framework, which corporations must use to assess their energy use and identify energy savings, has six Key Elements. Each element has specific Key Requirements that the corporations must meet (RET 2006, 42-50), comprising:

- **Leadership** – managers must set and communicate energy use objectives and allocate the necessary people, time and money,
- **People** – staff with the necessary authority and energy expertise need to be assigned from across the business, and given defined roles and responsibilities,
- **Information, data and analysis** – data measurement systems and analytical techniques must be used so that energy use can be properly understood,
- **Identification and evaluation** – effective processes must be used to analyse the costs and benefits of opportunities from a whole-of-business perspective,

- **Decision making** – the results of energy assessments must be considered by senior decision makers, with timing and implementation clearly defined, and
- **Communicating outcomes** – results must also be communicated to the corporation’s board, employees and the wider community.

Evaluation strategy for the program

A strategy for evaluating the success of Energy Efficiency Opportunities in achieving its outcomes was developed as part of the program’s management plan. The “object” of the Energy Efficiency Opportunities Act (2006) 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.” In evaluating that outcome, several questions need to be answered: What has been the legislation’s impact on the knowledge, processes and systems corporations have in place to manage energy use? What barriers have been addressed and which ones remain? What impacts have the energy assessments and reporting had on the identification and adoption of cost-effective energy efficiency opportunities?

The evaluation strategy involves measuring firstly the effectiveness and secondly the efficiency of the program, using specific performance indicators. *Effectiveness* measures how well the program outcomes are achieving the program objectives. Program effectiveness criteria are:

- Level of participation in the program by qualifying corporations,
- Improvement in the way energy use is assessed, managed and understood;
- Improvement in the identification of energy efficiency opportunities,
- Improvement in the implementation of energy efficiency opportunities, and
- Savings in energy (and related greenhouse gas emissions), improvements in energy efficiency and achievement of net financial benefits resulting from participation in the program.

Efficiency measures the extent to which the program outputs are maximised for a given level of inputs. Outputs include program guidelines and procedures, stakeholder communications such as the website, newsletter and information sessions, capacity building for participants including workshops, training and guides. Criteria for evaluating the efficiency of these outputs are: achievement of project milestones; key stakeholder satisfaction; and effective communication of program goals and results.

The three phase evaluation of the program is built into the milestones that corporations must adhere to over the program’s five-year cycle, as shown in Figure 2. Corporations are required to report detailed data three times during the assessment cycle: at the time they submit their Assessment Plan, half-way through the cycle, and at the end of the cycle. This data is aggregated and analysed during the cycle. This enables the department to collect, track and measure the change in energy use, energy efficiency, energy assessment processes and systems and resulting energy savings. The three phases of evaluation are discussed below.

Evaluation Findings: Phase 1 Early Evaluation

The early evaluation was conducted internally by the Department of Resources, Energy and Tourism using information and data provided to government by the first tranche of 199 corporations in their Assessment Plans. The department measured corporations’ program participation and their level of energy use, which were found to correlate with estimates of energy use by large energy users in earlier national statistical surveys (ABS 2005). Energy use data also confirmed that corporations registered with the program had energy use above 0.5 PJ per year and were therefore required to participate under the legislation.

The early evaluation also measured corporations' intentions to improve existing systems and processes, or introduce new policies or practices to meet Assessment Framework requirements. Most recognised the need to make major or moderate changes, with almost half (46 per cent) expecting major changes and 33 per cent moderate changes. Only 20 per cent believed they would only require minor changes. The highest expectations for change were in communication, where 60 per cent predicted major changes. Moderate change was expected in the leadership and information requirements, and data and analysis. This finding on data conflicted with feedback from industry workshops held by the department and earlier government program experience, so the department placed more emphasis on data and analysis in subsequent capacity-building workshops and materials.

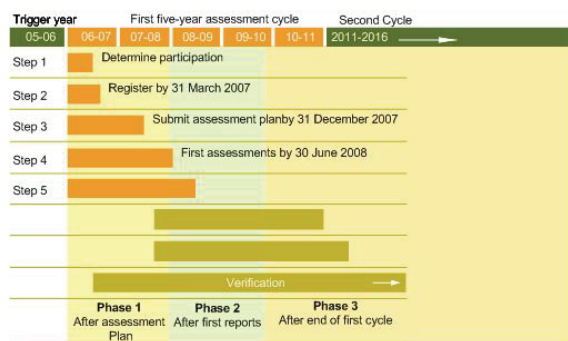


Figure 2. The three phases of EEO program evaluation

Evaluation Findings: Phase 2 Mid Cycle Review

The external Mid Cycle Review was conducted to measure the impact of the program's assessment and reporting requirements, evaluate the effectiveness of the communication and capacity-building activities, and provide an update on the perceptions of barriers to improved energy efficiency. The consultants gathered quantitative data through an online survey of 211 corporations and qualitative data through 37 interviews with coordinating managers from 25 corporations plus energy services and finance sectors representatives. The 104 survey responses represent around half (49 per cent) of participants accounting for 46 per cent of program energy use, and broadly represented the profile of the corporations registered with the program. The consultants' review was supplemented by information gathered in workshops with participants, workshop evaluations, case studies and feedback from industry members. Comments by participants in the online surveys, interviews and departmental work are used below to illustrate the data findings, which are described according to the Key Elements in the Assessment Framework.

Leadership and Accountability

The leadership key element requires senior and operational managers to provide direction and resources for energy assessments. Almost half (46 per cent) of respondents found their energy efficiency objectives had changed through leadership direction, with 77 per cent indicating they now had clear objectives to improve energy efficiency. The priority given to energy management, and levels of internal accountability, had also changed. Nearly a third of respondents had no leadership or accountability for energy management prior to registration, with half assigning it as a part-time function (see Figure 3).

Prior to participation, only 6.8 per cent had a full-time energy manager and 7.8 per cent senior management accountability. However, the number of corporations with senior management accountability

has doubled since participation, and those with full-time energy managers almost tripled. Only three corporations indicated they did not have any leadership or accountability for energy management, with most respondents assigning energy management as a part-time function.

The importance of leadership in conducting rigorous energy efficiency assessments was also highlighted by respondents. Around a third initially indicated lack of interest or support from senior management as a barrier to opportunity identification, and 24 per cent said it was a barrier to implementation. Following program participation, 12 per cent thought this was still a barrier to identification and less than 5 per cent to implementation. Nine out of 10 respondents nominated leadership support as important or somewhat important in the Assessment Framework.

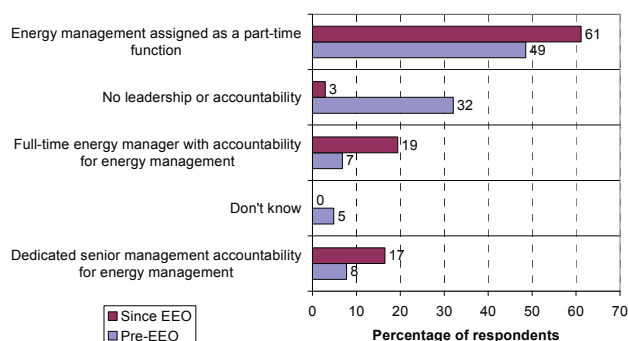


Figure 3. Leadership and accountability impact of participation in EEO

People and Processes for Opportunity Identification

The People element requires skilled and influential people to be involved in identifying and implementing the energy efficiency opportunities. Prior to the program, 51 per cent of respondent businesses had no single point for energy management and 15 per cent had no energy staff or support (Figure 4). After participation, the corporations either allocated responsibility for energy issues in a single department's broader responsibilities – from 28 to 46 per cent of respondents; or they had a dedicated cross-organisational energy team with a mix of technical and management skills. Only 7 per cent of corporations had this sophisticated approach prior to the program, compared with 27 per cent following program participation.

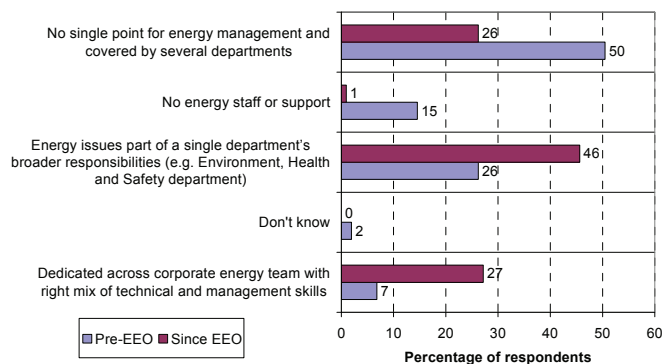


Figure 4. Staffing to identify and implement EEO before and after program participation

Companies are required to develop effective processes to identify and evaluate the whole-of-business costs and benefits of opportunities with paybacks up to four years, and prepare business cases for

implementation. The survey indicated that corporations had significantly shifted their approach to assessments. Two-thirds of respondents had previously identified opportunities on an ad hoc basis (Figure 5). Introducing a more formal process led to 27 per cent using an energy assessment team and 52 per cent saying they had a well-documented process involving a cross-section of people supported by management. One company found having a “fairly stringent assessment process” the most effective program requirement.

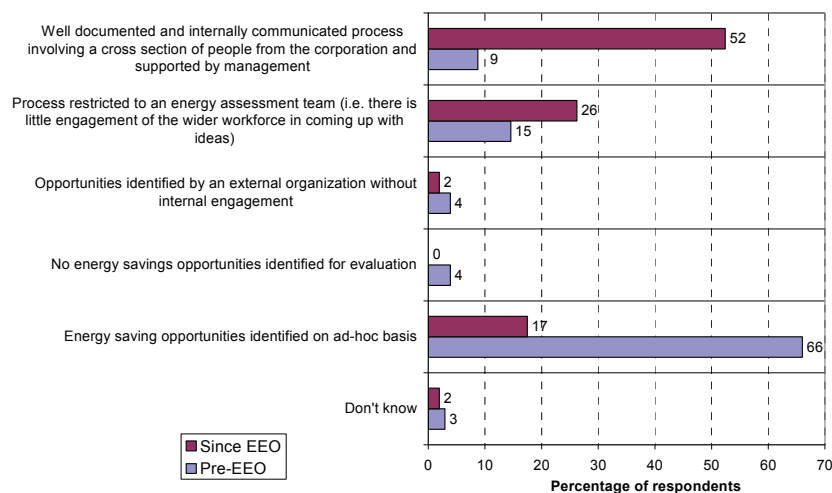


Figure 5. Process for identifying and evaluating opportunities

Data and analysis

Information, data and analysis key requirements aim to improve the rigour of energy data collection and analysis, and place it in the business context. Respondents rated data and analysis as the most important assessment requirement. Prior to the program nearly 70 per cent of respondents collected data of different standards but did not analyse it, and six respondents had no data collection system in place. Since the program, 61 per cent of respondents now have a well-documented process for data collection and analysis of energy use trends and potential savings (Figure 6). Significantly, nearly 40 per cent indicated that data of different standards was collected but no analysis conducted, compared to 70 percent initially, noting that other policy measures in Australia would also have encouraged improved energy data collection methods.

Corporations are encouraged to use a range of energy data analysis approaches, from traditional benchmarking and performance tracking to the more innovative energy material flows and theoretical benchmarking. Applicability of methods varies, but all of the approaches were found to be effective for some corporations. Tracking energy use over time and relative to operating and production parameters was found to be most effective, with 86 of 100 respondents rating this approach as effective or very effective. Energy efficiency indicators and benchmarking was the next most useful approach, followed by project tracking (Figure 7). Interestingly, 30 corporations found comparing energy use to theoretical or thermodynamic limits useful; however, 25 disagreed, 20 did not know and 27 rated it not applicable to their business.

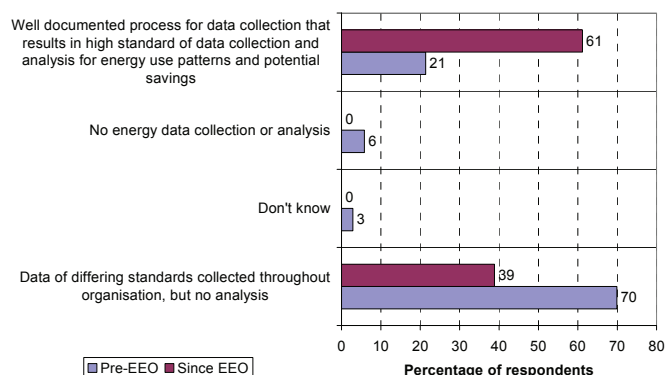


Figure 6. Analysis of energy usage data

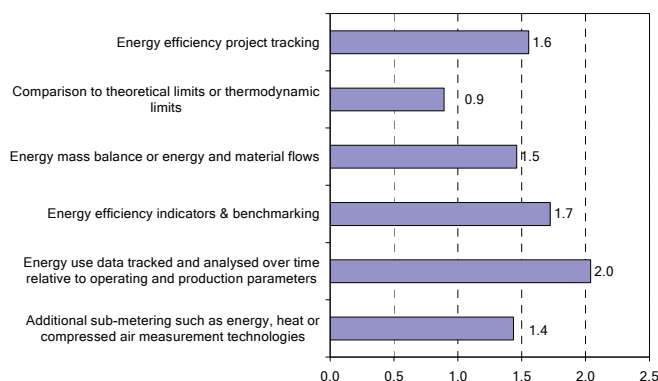


Figure 7. Effectiveness of data collection and analysis approaches. *Average rating (responses are given a score and divided by number of respondents - not effective -1, effective - 2 and very effective – 3)

Evaluation Findings: Phase 2. Corporations' Results 2006 – 2008 and updates

The second major component of the mid cycle program evaluation is analysis of the results of the corporations' first energy efficiency assessments. The companies report to government on their assessments halfway and at the end of the five-year cycle. Corporations report on their total energy use, identified energy savings opportunities, their business response and the potential financial and benefits that could be gained from implementation of projects. The department aggregated and analysed the results submitted in December 2008 (RET, 2010b), with highlights described below.

The first 199 corporations had assessed 1,019 PJ, or 57 per cent, of their total energy use by 2008, identifying more than 7,000 opportunities to improve energy efficiency with a payback period of four years or less. These opportunities had the potential to save 62 PJ, which is equivalent to reducing Australia's total greenhouse gas emissions by 1.1 per cent or 6 million tonnes of carbon dioxide-equivalent (MtCO₂-e). The corporations estimated these energy savings opportunities could generate net financial savings of \$A736 million if implemented. The corporations had implemented or were planning to implement more than 3,100 of the opportunities, representing 63 per cent of the energy savings that were identified. These opportunities were projected to save 39 PJ per year, which is equivalent to nearly 1 per cent of Australia's total energy end use in 2007-8. Such a saving would yield a reduction of 4 MtCO₂-e emissions per year, and net annual financial savings of \$A503 million.

A significant achievement was that corporations identified energy savings represented an aggregate

6.1 per cent of the energy use assessed (Figure 8). More than 30 corporations also identified savings greater than 20 per cent of assessed energy, reducing their energy consumption by 24.1 PJ. Most corporations conducting assessments were energy intensive, with energy constituting a significant proportion of their operating costs. Improvements in the energy efficiency of Australia's energy-intensive industrial sector averaged 0.4 per cent a year between 1990 and 2007. This figure varied over the period, and ranged from 4 per cent a year for aviation to a negative 3 per cent for mining, and is not directly comparable with the 6.1 per cent achieved under the program. However, the results reported in the first assessments are significant. The Phase 3 Full Evaluation will provide a better indication of the impact of identified savings on overall efficiency improvement.

Two-thirds of identified energy savings (41.8 of 62.5 PJ) had less than 2 year paybacks, whereas one-third of identified savings had two to four year paybacks. This varied by sector. More than 87 per cent of the savings identified in the mining industry and 62 per cent in metals manufacturing were in projects with less than two year paybacks. By contrast, the services industry reported 71 per cent – in the greater than 2 year payback category. Savings in the remaining industries of transport and other were spread in roughly equal portions across the two categories.

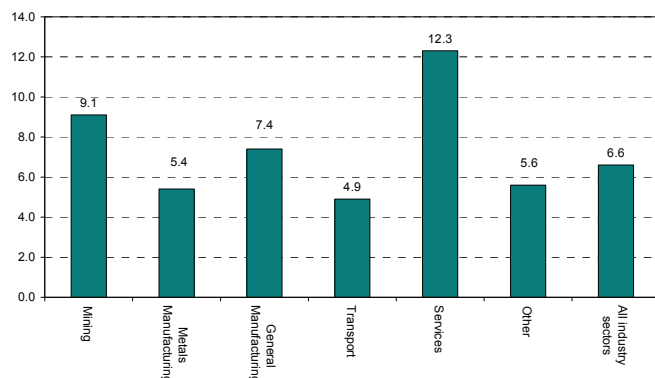


Figure 8. Identified energy savings as a percentage of assessed energy use

In December 2009, 199 corporations, including 186 that reported in 2008, reported publicly on further assessments and updated their original assessments. Further results were reported by 207 corporations in December 2010. On aggregate, corporations reported assessing 85 percent of total energy use in 2010, up from 82 per cent in 2009 and 57 per cent in 2008. Given that the legislation requires corporations to assess 80 per cent of their total energy use and all sites using greater than 0.5 PJ by the end of the first five-year cycle in 2011, the corporations are well progressed in fulfilling their coverage requirements.

Significantly the 207 corporations reported 109.5 PJ identified in energy efficiency opportunities with less than 4 year paybacks. This is 7.6 per cent of assessed energy and 1.9 per cent of total Australian energy use. This is 16 PJ in additional energy savings, an 18 per cent increase since 2009 and 47 PJ more than the 62.5 PJ identified in 2008. Results reflect the outcomes of additional assessments, and subsequent investigation of opportunities resulting in greater energy savings. Implementation rates as a percentage of identified opportunities have remained stable, at 61 percent (66.4 PJ) in 2010 compared to 60 per cent (56.3 PJ) in 2009 and 63 per cent (39.3 PJ) in 2008. Energy savings reported as “not to be implemented” increased from only 1.4 PJ in 2008 to 10 PJ in 2009 and 14.4 PJ in 2010 as projects were further investigated.

Mid Cycle Review– Further Evaluation Issues

The Evaluation Findings for the Mid Cycle Review described earlier for the Key Elements of the program indicate that the systems and processes being used by the corporations to assess, identify and evaluate their opportunities are changing. The Mid Cycle Evaluation considered whether those changes are leading to the *implementation* of energy savings opportunities.

The evaluation shows that barriers to *identification* are being reduced substantially. Prior to conducting assessments, 36 per cent nominated lack of suitable data as a barrier, 32 per cent lack of senior management support, and 46 per cent the absence of a responsible manager. Following their participation in the program, the proportion naming each barrier dropped substantially to 14 per cent, 12 per cent and 3 per cent respectively. The lack of available budget, time and resources also declined from 56 per cent to 41 per cent. Similarly, the barriers to *implementation* had been lowered – “lack of capital budget to implement opportunities” decreased from 42 per cent to 38 per cent; “investment in energy efficiency opportunities is low priority relative to core business/licence to operate” went from 42 per cent to 25 per cent and “lack of available time and resources to implement” went from 51 per cent to 37 per cent.

During the last four years, other internal and external factors have influenced implementation rates. The boom in demand for Australia’s natural resources combined with the global financial crisis (GFC) would have impacted on labour and capital resources availability for project implementation. For many, the GFC decreased the availability of capital and resources to investigate and implement energy savings requiring capital. Conversely, the GFC gave a greater focus to energy cost reduction. During this time, the Australian Government’s proposed introduction of an emissions trading scheme, the Carbon Pollution Reduction Scheme (CPRS), and the introduction of the National Greenhouse Energy Reporting scheme (NGERs) also encouraged additional data gathering and verification as corporations used the assessments to prepare their marginal cost of abatement curves. During this period some corporations developed highly public corporate greenhouse reduction goals.

The third area to examine in finalising the Mid Cycle Evaluation is the effectiveness of Key Elements of the Assessment Framework in motivating change. When asked about the most useful assessment and reporting requirements, respondents nominated the Assessment Plan as the most useful, followed by reporting to the board and CEO and the Assessment Framework. Public and government reporting was seen as the least useful requirement. Almost 30 per cent of corporations indicated that no aspect of the assessment and reporting frameworks had helped to identify and implementing energy efficiency opportunities.

Corporations identified reporting to the board as effective in building leadership support. While nearly half of respondents said their business already reported energy consumption and spending to the board, only 20 per cent had also reported the potential for energy efficiency opportunities. Of the 46 respondents to questions about the impact of board reporting, seven indicated it had had little or no impact—partly because businesses already had board reporting, or the inherent nature of the business reduced interest in energy at board level. Others made neutral statements such as “too early to tell” or the board was “already supportive” of energy efficiency. However, half of respondents said the requirement had increased awareness of energy costs and energy savings opportunities, which had led in some cases to improved support for capital expenditure. Respondents’ comments included: “*Better support for initiatives and understanding of energy use*”; “*Gained much better high-level support for the EEO project*”; “*Capital money available*”; “*Greater understanding of the importance of energy consumption within the business and scrutiny of energy consumption by the board*”; and “*With each positive improvement the board is taking on the relevance of the EEO. Projects are easier to get approval.*”

The poor rating of public and government reporting was most surprising as consultations with industry members showed this was expected to provide extra impetus for decision makers to consider implementing opportunities. In practice, however, most interviewees saw public reporting as a compliance exercise that duplicated other reporting requirements without providing the expected leverage for change.

The finance sector had shown limited interest in the reporting, partly because results are reported in gigajoules, which had limited meaning for many analysts. Only about a third of the 199 reporting corporations in 2008 were among Australia's top 200 publicly listed companies, which reduced their likely response to public attitudes to energy and environmental management. Corporations with strong links to their customer and shareholder base viewed public reporting as useful, but they were a minority. These consumer-oriented businesses already reported their energy usage results in different forms of environment or greenhouse gas emissions reporting.

Conclusion

The Energy Efficiency Opportunities program was established in 2006, primarily to address the organisational and information failures preventing optimal take-up of cost-effective energy efficiency by large energy users. The rationale was that making energy users and the market aware of the size and value of energy savings could lead to greater implementation of opportunities.

The department collects detailed energy use, efficiency and opportunities data at three points in the five-year cycle of the program to coincide with and inform the three phases of evaluation. The Phase 1 and Mid Cycle evaluations aimed to measure the initial impact of the program and its assessment requirements on the systems and processes corporations had in place to understand and manage their energy use. Where possible, it also sought to measure the initial impact on the identification and implementation of energy savings. The Final Evaluation will be able to better examine the impact of the assessments on overall energy efficiency performance along with the savings opportunities reported.

Early findings from the Mid Cycle Review indicate that while experience of the program varied by corporation, overall there was a marked improvement in the systems, processes and levels of accountability for energy management in many corporations. Improved data and analysis, and board reporting of results, emerged as the most valued and effective elements of the assessment process. While some viewed aspects of the process as not driving change, they also acknowledged the importance of all the elements in achieving some benefits. Public reporting seemed to be the least valued program requirement, partly due to perceived duplication with other reporting schemes, and partly because it had not provided the leverage expected to improve the implementation of opportunities and, therefore, the effectiveness of the energy assessment.

Since the introduction of Energy Efficiency Opportunities there has been a marked reduction in the perceived barriers to the identification of energy efficiency opportunities, such as the quality of data, and the skills and seniority of people involved. Similarly, there has been a lesser decrease in the perceived barriers to implementation such as lack of access to capital.

The energy savings results reported by the program are significant. In December 2010, 207 corporations reported 109.5 PJ in identified energy savings with paybacks under four years. This is 7.6 per cent of corporations' total assessed energy, 1.9 per cent of Australia's total energy use and an estimated 1.1 per cent of Australia's greenhouse gas emissions. It is difficult to draw a direct correlation between assessments and energy savings results at this time. However, case studies and responses to surveys and interviews indicate that assessments are resulting in improved identification of opportunities for corporations with weak pre-existing systems or a constructive attitude to the assessment. In some cases this was improving implementation, particularly of low-cost opportunities with less than 2 year paybacks. However, many organisations perceived that they already had adequate systems in place and that while the assessment requirements improved the rigour of those systems, they did not necessarily identify greater savings. Implementation barriers persisted for many firms, exacerbated by the global financial crisis,

particularly for projects with longer paybacks or large capital requirements.

The true impact of Energy Efficiency Opportunities on the identification and implementation of additional energy savings opportunities over the long term will require individual assessments of companies that believe they already had the existing systems in place. In addition, the Stage 3 Final Evaluation of the program will examine the energy efficiency data against three data points - 2006-2007, 2007-2008 and 2010-2011 - enabling a better indication of energy efficiency improvement over time. Nonetheless, the key lesson from the mid-cycle results is that, mandating rigorous energy assessments, supported by capacity building, can significantly reduce barriers to energy efficiency project identification and implementation for large energy users. By targeting the largest energy users, it is also possible to achieve a significant impact on energy use at a national level.

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<http://www.energyefficiencyopportunities.gov.au> for case studies, workshop presentations and summaries, guidelines, corporations' public reports.