



# DELIVERING BUSINESS BENEFITS FROM ENERGY EFFICIENCY: THE ACHIEVEMENTS OF EPA VICTORIA'S INDUSTRY GREENHOUSE PROGRAM

A PROGRAM IMPLEMENTING THE PROTOCOL FOR ENVIRONMENTAL MANAGEMENT 'GREENHOUSE GAS EMISSIONS AND ENERGY EFFICIENCY IN INDUSTRY'

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'GREENHOUSE GAS EMISSIONS AND ENERGY EFFICIENCY IN INDUSTRY'

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## VERIFICATION STATEMENT

To the Chairman, Directors and stakeholders of the EPA Victoria:

The Environment Protection Authority, Victoria (the EPA) commissioned Net Balance Management Group Pty Ltd (Net Balance) to provide a statement, representing our independent opinion on the integrity of information presented within the Industry Greenhouse Program (IGP) Report (this report). This report on the outcomes of the IGP was prepared by the EPA and this statement represents our independent opinion. Net Balance's responsibility in performing our activities is to the Chairman and Directors of the EPA alone and in accordance with the terms of reference agreed with them. Any reliance third-parties may place on this statement is entirely at their own risk.

The objective of the verification process is to provide the EPA and its stakeholders with an independent opinion on the accuracy of the information presented within this report. This is confirmed through verification of the information provided at a broad desk-top level, reviewing underlying systems, processes and competencies that support the claims made within this report.

The verification process was subject to the following limitations:

- The process was undertaken through a 'desktop' review of data provided by the EPA. No sites were visited by Net Balance as part of the assurance process.
- All reported reductions in greenhouse gas emissions (expressed as a percentage reduction in CO<sub>2</sub>-e) are based on 2003 baseline data calculated from site audits that were undertaken prior to commencement of the program. They are reductions on what would have occurred under a 'business as usual' case and are not absolute reductions. In some cases it was found that while greenhouse gas emission saving actions were undertaken, these were more than offset by increases in greenhouse gas emissions, which may have been a result of increased production, a change in energy mix, or a change in production composition.
- The greenhouse gas emissions savings identified as being achieved under the IGP are based upon written and verbal statements made by companies to the EPA. In some cases, site inspections were undertaken by EPA representatives to confirm that actions were implemented.
- That, although this report predominantly looks at actions achieved by the IGP to the end of 2006, the program has been influential in identifying additional actions beyond the original timeframe of the program. These actions will need to be implemented over future years, with the benefits of these yet to be achieved.
- That, in the absence of accurate metering of individual processes to assess actual greenhouse gas savings, estimates of reductions in CO<sub>2</sub>-e emissions made by audit teams at the inception of the program are representative of improvements achieved by implemented actions.
- That reductions in CO<sub>2</sub>-e emissions from reduced electricity consumption are based upon electricity emission factors prior to IGP implementation. These emission factors, determined by the Australian Greenhouse Office, vary from time to time for a number of reasons including changes in fuel mix, meaning that the actual greenhouse gas emission savings resulting from reduced electricity consumption might vary slightly from those reported.
- That, in some cases, companies had identified and committed to greenhouse gas reducing actions prior to the commencement of the IGP under voluntary programs such as the Commonwealth Government's Greenhouse Challenge Program. Where the outcomes of these actions have been included as part of the IGP, comments made by the companies in question led the EPA to believe that these actions were brought forward and implemented because of the regulatory nature of the IGP that provided added incentive and focus to implement actions within the designated timeframes.

Based on the scope of the assurance process, the findings of the verification engagement provide confidence in the information reported within this report subject to the above limitations. Data trails selected were easily identifiable and traceable, and the personnel responsible were able to reliably demonstrate the origin(s) and interpretation of data.

On behalf of the audit team  
16th August 2007  
Melbourne, Australia



Terence Jeyaretnam  
Director, Net Balance & Lead CSAP (IRCA UK)

## ACKNOWLEDGEMENTS

EPA Victoria wishes to acknowledge the contributions of a range of stakeholders to the success of the Industry Greenhouse Program, including EPA licence holders and works approval applicants, the energy auditing industry, Sustainability Victoria and the Department of Sustainability and Environment. The assistance of Environment Link Pty Ltd in gathering case study information and undertaking client feedback interviews is also acknowledged.

## ABBREVIATIONS

CO <sub>2</sub> -e	Carbon dioxide equivalents
EPA	Environment Protection Authority Victoria
GHG	Greenhouse gas
IGP	Industry Greenhouse Program
Mt	Million tonnes
PEM	Protocol for Environmental Management 'Greenhouse Gas Emissions and Energy Efficiency in Industry'
PJ	Petajoules (one million billion or 10 <sup>15</sup> joules)
Program	EPA Industry Greenhouse Program
SEPP (AQM)	State Environment Protection Policy (Air Quality Management)
TJ	Terajoules (one thousand billion or 10 <sup>12</sup> joules)
VGS	Victorian Greenhouse Strategy

## **EXECUTIVE SUMMARY**

EPA Victoria's Industry Greenhouse Program was the first regulatory greenhouse and energy efficiency program for industry in Australia, and one of the first in the world. Applying to EPA licence holders and applicants for works approval, the program has been in place since 2002.

Licence holders were required to:

- assess their annual site-based energy use and greenhouse gas (GHG) emissions
- depending on these, undertake an energy audit and assess opportunities for improvement
- prepare a plan to implement actions with payback periods of three years or less
- implement their approved action plan from 2004.

The program for licence holders has almost been completed. Applicants for works approval were required to apply best-practice measures to any new works; these requirements will continue to be applied.

This report presents and discusses the outcomes of the program, some of the key ones being:

- GHG emissions abatement of 0.88 Mt CO<sub>2</sub>-e/yr at the end of 2006, increasing to 1.23 Mt CO<sub>2</sub>-e/yr at the end of 2007 (equivalent to taking 286,000 cars off the road)
- energy cost savings of \$24.9 million/yr to participating companies at the end of 2006, increasing to \$38.2 million/yr at the end of 2007
- an average payback period per action of 20 months.

Approximately one third of actions taken had a payback period of less than six months. These actions achieved a quarter of the total GHG reductions and provided cost savings of \$18 million/yr.

The program achieved energy reductions equivalent to one year's growth in electricity demand and three years' growth in natural gas demand for all of Victoria, thereby contributing to deferring the need for investment in electricity generation, and gas production and processing, capacity and associated distribution infrastructure.

New or modified works valued at more than \$2 billion have been the subject of works approval applications since the beginning of the program. This investment in Victoria has been undertaken using best-practice energy efficiency and GHG emission management measures.

Feedback has confirmed that Victorian industry is now better placed to manage its carbon emissions than it was prior to the program, but various improvements have been suggested that could be applied in future programs of this type. A more inclusive energy audit process (engaging with on-site staff) would lead to more improvement actions being successfully implemented. Also, since 10 per cent of participating sites achieved about 80 per cent of the program's abatement results, future programs might benefit from higher participation thresholds.

EPA is now building on the success of the program by developing a new Environment and Resource Efficiency Plans program that will require site assessments and the subsequent implementation of cost-effective improvements in energy, water and waste efficiency at large energy and water-using sites in Victoria.

## FOREWORD

Climate change is the most important environmental issue facing the world today. It is recognised that our use of energy is one of the key contributors to this issue. This is especially true in Victoria, where over 84 per cent of the State's greenhouse gas emissions arise from energy use.

Reducing our greenhouse gas emissions as a means of tackling climate change requires us to reduce the impact of our energy use. We can do this by reducing the amount of energy we use and by using forms of energy that produce lower greenhouse gas emissions.

Energy efficiency is the logical first step in meeting this challenge, because it is the cheapest and fastest option. Energy efficiency is the most cost-effective way to cut energy use and the associated greenhouse gas emissions. It has the potential to cut the State's growing need for energy, reduce our future energy and infrastructure costs and at the same time address the challenge of global warming. It can be introduced quickly by undertaking improvements or relatively minor upgrades to existing facilities, without the need to wait for substantial new investment decisions. Analyses show that energy efficiency is a productivity investment that strengthens the economy while adding to employment.

Energy efficiency offers Victoria a path towards a sustainable energy future that provides greater energy security, costs less, pollutes less, and supports economic growth.

EPA's Industry Greenhouse Program is a flagship energy efficiency program that has shown how effective energy efficiency can be. By the end of 2007, the program will deliver a greenhouse gas reduction of over 1.2 million tonnes of carbon dioxide equivalent per year, equivalent to taking 286,000 cars off the road permanently, and over 70 per cent of this reduction has occurred already. Industry will benefit to the tune of \$38 million per year in reduced energy costs, with the investment costs paid back in only 20 months on average.

The reduced electricity and natural gas usage will take up one year's growth in electricity demand and three years' growth in gas demand for the whole of Victoria.

The Industry Greenhouse Program demonstrates that energy efficiency is good for the environment and good for business. This report includes summaries of several case studies that show the gains achieved by companies operating in different sectors; their common link in this case has been that they have each profited from taking positive steps to improve their energy efficiency.

The Victorian Government will continue to promote energy efficiency as a means of reducing our greenhouse gas emissions, and has charged EPA with developing a new program that will deliver further benefits to business through resource efficiency measures, so that the optimal integrated improvements will be made in energy, water and waste. We look forward to reporting on the benefits delivered through this program in years to come.



Mick Bourke  
Chairman, EPA Victoria



Hon Gavin Jennings  
Minister for Environment and Climate Change

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## 1. INTRODUCTION

EPA Victoria's Industry Greenhouse Program (the program) was the first regulatory greenhouse and energy efficiency program for industry in Australia, and one of the first in the world. The program was announced as part of the 2002 Victorian Greenhouse Strategy (VGS)<sup>1</sup>, and in accordance with the requirements of the *State Environment Protection Policy (Air Quality Management)* (SEPP (AQM))<sup>2</sup>. Program requirements were described in the *Protocol for Environmental Management: Greenhouse gas emissions and energy efficiency in industry* (the PEM)<sup>3</sup>, an incorporated document of SEPP (AQM).

As well as outlining general requirements for best practice and continuous improvement in relation to energy efficiency and greenhouse gas (GHG) emissions, the PEM outlined a specific program of actions for EPA licensees. All sites were required to measure their energy use and GHG emissions, and large sites were then required to undertake an energy audit and implement any actions with a payback period of three years or less. Implementation of the program was required to be completed by the end of 2006.

A report entitled *The EPA Victoria Industry Greenhouse Program – The story so far*, issued in February 2006<sup>4</sup>, described the program requirements, its implementation and the expected outcomes based on the action plans approved under the program.

This report presents and assesses the final outcomes based on the confirmed actions implemented under the program. It also provides observations about the program's successes and notes where improvements could be made for future programs. Information has been obtained from company reporting and site verification inspections. The report:

- contains information about Victoria's policies for greenhouse gas emissions and energy efficiency
- gives information about Victoria's energy use and greenhouse gas emissions
- provides the verified outcomes of the program in achieving greenhouse gas (GHG) emission reductions from industry
- demonstrates the cost-effectiveness to industry of the program
- includes a range of analyses of the program outcomes
- summarises some of the results achieved in case studies
- provides a summary of feedback received from industry about the program.

<sup>1</sup> See DNRE (2002).

<sup>2</sup> See State of Victoria (2001).

<sup>3</sup> See EPA Victoria (2002).

<sup>4</sup> See EPA Victoria (2006).

## 2. VICTORIA'S GREENHOUSE GAS AND ENERGY EFFICIENCY POLICIES

### Victorian Greenhouse Strategy

The Industry Greenhouse Program was announced as part of the Victorian Greenhouse Strategy (VGS), which was launched by the Victorian Government in June 2002. Under the VGS, EPA Victoria was given the responsibility to undertake a program that would see those industries subject to its works approval and licensing system take advantage of cost-effective opportunities to improve energy efficiency and reduce greenhouse gas emissions. The VGS noted that these efforts would not only deliver environmental benefits, but also enhance business competitiveness by reducing costs, improving risk management, increasing the confidence of investors, insurers and financial institutions and by improving relationships with local communities.

### State Environment Protection Policy (Air Quality Management)

The release of the VGS was preceded by the proclamation of the revised SEPP (AQM) in December 2001. The revised SEPP (AQM) aimed to 'support Victorian and national measures to address the enhanced greenhouse effect' (Clause 6), and introduced 'climate systems' as a beneficial use to be protected by the policy (Clause 9). It required generators of emissions of greenhouse gases to manage those emissions in accordance with the principles of best practice and continuous improvement. The policy also enabled EPA to establish protocols for environmental management that would be applied to generators of GHG emissions subject to works approvals and licences, and in assessing the potential impacts of other development proposals.

Further guidance about what constituted best practice for the management of GHG emissions was provided in the PEM *Greenhouse gas emissions and energy efficiency in industry*.

### Protocol for Environmental Management: Greenhouse gas emissions and energy efficiency in industry

The PEM was released in January 2002 and is an incorporated document of the SEPP (AQM). It specifies the steps businesses must take to manage their energy use and greenhouse gas emissions, and how EPA assesses compliance, with particular regard to Clause 33(1), (2) and (3) of the SEPP (AQM).

Applying to businesses subject to EPA's works approval and licensing system, the PEM required the take-up of cost-effective opportunities for greenhouse gas mitigation. These requirements are outlined briefly in section 4 of this report, and in more detail in *The story so far* report mentioned above.

### Victorian Greenhouse Strategy Action Plan Update 2005

In April 2005 the Government released the *Victorian Greenhouse Strategy Action Plan Update 2005* (VGS Update)<sup>5</sup> to further progress work initiated through the VGS. This acknowledged the need for further action to reduce greenhouse gas emissions and stated that EPA would 'continue its work with energy-intensive industry sectors to drive improvements in energy efficiency and resultant reductions in greenhouse gas emissions, and to continue to develop and employ appropriate statutory greenhouse tools in line with Victorian Government policy'.

As a result of this commitment, EPA Victoria is developing a new program called Environment and Resource Efficiency Plans, described in Chapter 7 of this report.

### 3. VICTORIA'S ENERGY USE AND GREENHOUSE GAS EMISSIONS

#### Victoria's Greenhouse Gas Emissions, 2005

The current greenhouse gas inventory for Victoria is summarised in Table 1<sup>6</sup>. It shows that the total greenhouse gas emissions for 2005 were 125.4 Mt CO<sub>2</sub>-e, (or 121.9 Mt when greenhouse sinks such as reforestation are included). This is an increase of 21.8 Mt or 21.0 per cent above 1990 emission levels (13.6 Mt, or 12.6 per cent, when sinks are included). Victoria's 2005 net emissions of 121.9 Mt represented 21.8 per cent of the national total.

The energy industries sub-sector, including electricity generation and its use throughout the State, petroleum refining and the production and processing of briquettes and natural gas, contributed 54.8 per cent of the State's GHG emissions. (Note that emissions from electricity use in Victoria are proportionally higher than in other States due to the high emission properties of brown coal.)

Emissions from other fuel use within the manufacturing and construction industries comprised 4.3 per cent, while emissions from industrial processes comprised 2.3 per cent of the State's GHG emissions.

Table 1: Victoria's net greenhouse gas emissions by sector, 2005 (DSE 2007)

Sectors / subsectors	Net emissions, 2005 (Mt CO <sub>2</sub> -e)	% contribution of sector to total emissions, 2005	Change in emissions, 1990 to 2005	
			Mt	%
<b>Energy</b>	<b>102.9</b>	<b>84.4</b>	<b>22.6</b>	<b>28.1</b>
Energy industries	66.8	54.8	19.6	41.5
Manufacturing industries and construction	5.3	4.3	-1.6	-23.1
Transport	20.6	16.9	4.3	26.5
Fugitive emissions from fuels	1.8	1.5	-1.9	-52.2
Other sectors and lubricants	8.5	6.8	2.2	35.9
<b>Industrial processes</b>	<b>2.8</b>	<b>2.3</b>	<b>-0.8</b>	<b>-22.4</b>
<b>Agriculture</b>	<b>15.7</b>	<b>12.9</b>	<b>0.7</b>	<b>5.1</b>
<b>Land use, land use change and forestry</b>	<b>-3.5</b>	<b>-2.9</b>	<b>-8.1</b>	<b>-175.1</b>
<b>Waste</b>	<b>4.0</b>	<b>3.3</b>	<b>-0.8</b>	<b>-15.8</b>
<b>Total emissions/removals (including sinks)</b>	<b>121.9</b>	<b>100.0</b>	<b>13.7</b>	<b>12.6</b>

<sup>5</sup> See DSE (2005).

<sup>6</sup> See DSE (2007).

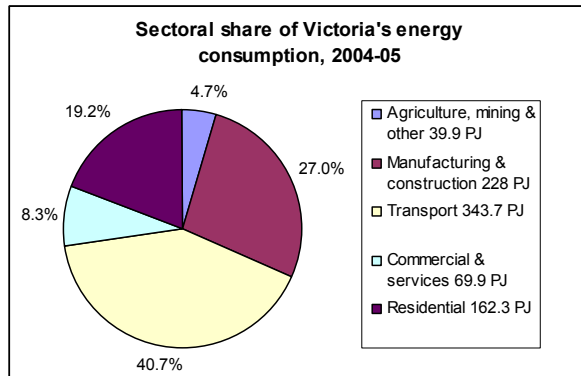
The emissions arising from the energy used by those EPA licence holders with action plans approved under the program were 30.1 Mt CO<sub>2</sub>-e per annum in 2003, or 24.7 per cent of the State's GHG emissions, while the total (energy-related plus non-energy related) GHG emissions from those sites was 64.5 Mt CO<sub>2</sub>-e per annum. This is not all reflected in Table 1, as emissions arising from electricity generated in Victoria but used interstate are not included in the table.

Victoria's per-capita GHG emissions in 2005 were 24.3 tonnes CO<sub>2</sub>-e, compared with Australia's per-capita emissions of 27.5 tonnes CO<sub>2</sub>-e<sup>7</sup>.

### Victoria's energy use, 2004–05

Figure 1 illustrates Victoria's annual end-use energy consumption by sector, after electricity generation, transmission and distribution are allocated to energy users. The industrial sector, with annual energy consumption of 268 PJ in 2004–05, currently uses slightly more gas and electricity than the residential and commercial sectors combined<sup>8</sup>. Based on anticipated production output, industrial energy use is predicted to increase by approximately one per cent per year and reach 313 PJ (or 17 per cent above 2004–05 levels) by 2020.

The industrial sector consumes about 54 per cent, the commercial sector 14 per cent and the residential sector 32 per cent of stationary energy.



**Figure 1: Sectoral shares of Victoria's energy consumption, 2004–05 (ABARE 2006)**

In 2003, energy consumption by companies with EPA licences was 174 PJ per annum, which represented 21 per cent of the State's total energy consumption (844 PJ) and 65 per cent of energy consumed by industry (including the manufacturing, construction, agricultural and mining sectors).

<sup>7</sup> See DSE (2007).

<sup>8</sup> See ABARE (2006).

### Implications for the Program

With these industrial sites representing such a high proportion of Victoria's energy use and greenhouse gas emissions, there was considerable scope for the Industry Greenhouse Program to contribute to the Victorian Greenhouse Strategy objectives.

Table 2 shows the energy use and GHG emissions associated with sites in the PEM categories A, B and C – refer to Section 4 of this report for description of the categories. More detailed analysis (see Tables A1 and A2 of Appendix A) shows that a small number of very large energy-using sites dominate the totals, with the largest 26 sites accounting for over 75 per cent of the energy use and almost 90 per cent of the GHG emissions of all IGP sites.

**Table 2: Energy use and GHG emissions by sites in PEM categories, 2003**

PEM category	Number of sites	Total energy use for sites in range, TJ/yr	Energy-related GHG emissions for sites in range, kt CO <sub>2</sub> -e/yr
C	281	172,939	88,734
B	221	731	718
A	275	153	132
Total	777	173,823	89,584

## 4. BRIEF OVERVIEW OF THE PEM

The PEM applied to businesses subject to EPA's works approval and licensing system. It required them to take up cost-effective opportunities for greenhouse gas mitigation, the benchmark being generally that actions should provide financial payback within three years or less.

A brief summary of the requirements for licence holders and works approval applicants follows. Further details may be found in *The story so far* report or in the PEM itself. EPA's implementation program for the PEM is described in *The story so far* report.

### Requirements for licence holders

EPA licence holders were required to determine their annual energy usage (by adding the energy value of electricity and all other fuels used on site) and the associated GHG emissions, as well as any non-energy related GHG emissions. The site was then placed into one of three categories, according to its energy use and energy-related GHG emissions, as shown in Table 3. This determined the next steps that needed to be taken.

**Table 3: Actions required by sites according to PEM categories**

PEM category	Definition	Action required
A (low)	<500 GJ/yr OR <100 t CO <sub>2</sub> -e/yr	Energy audit not required, but energy awareness encouraged.
B (medium)	All other combinations	Level 1 audit required. Inefficiencies to be addressed through an action plan.
C (high)	>7000 GJ/yr AND >1400 t CO <sub>2</sub> -e/yr	Level 2 audit required and feasible improvement actions to be undertaken through an action plan.

As shown in the table, Category A sites (small energy users) were not required to undertake an energy audit or prepare an action plan, while Category B (medium energy users) and Category C (large energy users) sites were required to undertake energy audits to analyse – and identify opportunities to reduce – energy usage. Where a complying energy audit had been undertaken within the previous three years, it could be used as the basis for compliance.

A licence holder with non-energy related GHG emissions was required to prepare an action plan to reduce these to a level consistent with best practice. This was determined by considering such factors as benchmarking against other similar operations, and technical and economic feasibility.

Licence holders were then required to submit a report to EPA containing the above information, including an action plan where applicable, by 31 December 2003. After approval by EPA, action plans were to be implemented over the period 2004 to 2006. Annual reports of energy usage, GHG emissions and progress in implementing action plans were to be provided to EPA.

The implementation of actions approved under the program has now been largely completed and the outcomes are summarised in the following chapters.

### Requirements for applicants for works approval

An EPA works approval must be obtained prior to the construction of new works or the modification of existing works. The application and approval process allows EPA to ensure, prior to its construction, that a proposal will meet all environmental requirements. The SEPP (AQM) requires that new proposals meet best-practice standards for their industry. The PEM ensures that the best-practice standard is also applied to the energy efficiency and GHG emissions aspects of a new proposal.

An applicant must estimate the likely energy usage of the proposed works and the associated GHG emissions. Any non-energy related GHG emissions must also be estimated. For proposals estimated to have energy use of more than 500 GJ/yr, or GHG emissions of more than 100 t CO<sub>2</sub>-e/yr, applicants must demonstrate that they have identified best practice in relation to energy use and GHG emissions for the proposed activities, and commit to implementing feasible best-practice measures. Best practice must also be identified in relation to any non-energy related GHG emissions associated with the application, and implemented where feasible.

These requirements, set out in more detail in the document *Guideline for Applicants – Energy and Greenhouse*<sup>9</sup>, continue to apply to works approval applications. The benefits obtained to the end of 2006 are summarised in following chapters.

## 5. THE RESULTS OF THE PROGRAM

### Expected outcomes

The *story so far* report outlined the expected outcomes of the program based on the approved action plans. In summary, the action plans indicated that companies participating in the program would:

- reduce their GHG emissions by 1.1 Mt CO<sub>2</sub>-e/yr
- achieve an average 3.5 per cent reduction in their annual GHG emissions (from a 2003 baseline)
- implement measures costing \$49 million to achieve annual savings of \$34 million, representing an average payback period of 17 months
- achieve approximately 20 per cent of the GHG reduction from actions with payback periods of three months or less.

The implementation status of the approved action plans has now been reported by companies and verified by EPA. While approximately 60 per cent of actions have been completed (and 70 per cent of GHG reductions achieved) within the time frame stated in the PEM, further progress continues to be made. This report provides information about the achievements to date and the anticipated final outcomes of the program.

### Actual outcomes

A summary of the actual outcomes of the program is shown in Table 4. Highlights are discussed in the following sections.

<sup>9</sup> See EPA Victoria (2006b).

Table 4: Major outcomes of the Industry Greenhouse Program, as completed at end 2006 (and expected at end 2007).

	No of actions completed at end 2006 (end 2007)	Expected GHG reduction under the IGP at end 2006 <sup>a</sup> , Mt CO <sub>2</sub> -e/yr	GHG reduction achieved at end 2006 (2007), Mt CO <sub>2</sub> -e/yr	Annual energy cost savings at end 2006 (2007), \$million/yr	Investment costs at end 2006 (2007), \$million
Approved IGP actions completed or underway	1197 (2237)	1.04	0.71 (1.03)	21.3 (34.4)	38.5 (53.1)
Approved IGP actions cancelled	471	0.15	0	0	0
Approved IGP actions for sites now closed or with licence surrendered	22 completed, 183 not completed	0.05	0	0.1	0.1
'New' IGP actions	157 (177) <sup>c</sup>	0	0.17 (0.20)	3.5 (3.6)	11.0 (11.4)
<b>Total IGP actions</b>	<b>1376 (2436)</b>	<b>1.24</b>	<b>0.88 (1.23)</b>	<b>24.9 (38.2)</b>	<b>49.6 (64.6)</b>
'Non-IGP' actions	22 (29) <sup>d</sup>	0	0.56 (0.61)	0.6 (0.6) <sup>b</sup>	69.3 (108.0)

Notes: a. According to approved action plans. b. Significant cost saving data was not available. c. Plus 9 actions cancelled. d. Plus 2 actions cancelled.

### Greenhouse gas emissions

On completion of all actions, now expected to occur during 2007, the program will deliver a total GHG reduction of 1.23 Mt CO<sub>2</sub>-e/yr. The reduction already delivered (at the end of 2006) is 0.88 Mt CO<sub>2</sub>-e/yr.

This varies from the total of 1.1 Mt CO<sub>2</sub>-e/yr reported in *The story so far* report, which was based on the reductions that were expected to be achieved from action plans that had been approved under the program at that time.

The variation from the projected reductions (as reported in February 2006) to those that will actually be delivered by the end of 2007 are due to:

- EPA licences surrendered or sites closed
- actions cancelled because
  - a production process may be closed or altered
  - the proposed action may be found to have unacceptable product quality and/or safety implications
- or
- the payback period may be found to have increased to more than three years because of cost increases or a reduction in potential savings
- additional actions to those originally identified have been undertaken at a number of sites where companies have found that more opportunities were available to them.

These factors are discussed further in chapter 6.

The net effect of these variations is to increase the final GHG reductions by approximately 10 per cent (0.13 Mt CO<sub>2</sub>-e/yr).

Moreover, a number of sites have gone beyond compliance by undertaking a range of actions not required under the program because they either had a long payback period or because they were committed under other programs. These 'non-IGP' actions amount to another 0.56 Mt CO<sub>2</sub>-e/yr already achieved and with another 0.04 Mt CO<sub>2</sub>-e/yr to be achieved by the end of 2007.

Figure 2 shows the cumulative distribution of GHG reductions to be achieved by the end of 2007, for IGP actions and for all actions (i.e., 'IGP' plus 'non-IGP' actions), by sites. This indicates that a large portion of the total GHG reductions is achieved by a relatively small number of sites. For IGP actions, the 34 highest GHG-reducing sites will collectively achieve reductions of one million tonnes CO<sub>2</sub>-e/yr. (In other words, 10 per cent of the sites will achieve 80 per cent of the program's GHG reduction.)

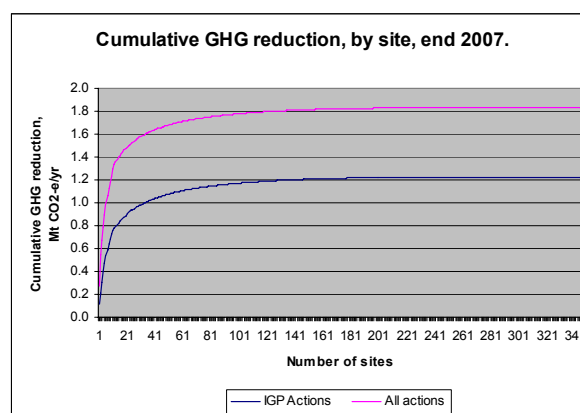


Figure 2: Cumulative GHG reductions by site, end 2007

For IGP actions, the anticipated total GHG reduction of 1.23 Mt CO<sub>2</sub>-e/yr includes 0.89 Mt CO<sub>2</sub>-e/yr in energy-related GHG emissions and 0.34 Mt CO<sub>2</sub>-e/yr in non energy-related GHG emissions. The energy-related GHG reduction equates to 3.0 per cent of the 2003 baseline for energy-related GHG emissions of 30.1 Mt CO<sub>2</sub>-e/yr.

**Costs and benefits**

At the end of 2006, industry had invested \$49.6 million on implementing actions under the program. The resulting energy cost savings of \$24.9 million per year represent an average payback period of 24 months. The expected costs and savings at the end of 2007, of \$64.6 million and \$38.2 million respectively, will give an average payback period of 20 months.

This shows a slight increase over the expected payback period of 17 months. This is mostly due to an increase in investment costs, averaging about 13 per cent, compared to the information in the approved action plans. It was noted that the extent of such cost over-runs varied considerably. In cases where this resulted in the payback period exceeding three years the action was usually not implemented (if the increased cost could be determined prior to orders being placed).

Key reasons for the cases where the most significant cost increases occurred included:

- insufficient collaboration between external auditors and on-site staff. Closer working relationships could have identified factors that were not evident to the auditor
- insufficient funding being provided for energy audits. This resulted in audits being conducted with limited time for the complete assessment of opportunities.

A total of 1376 actions were completed under the program to the end of 2006 and this is expected to increase to 2436 actions by the end of 2007. Cost and benefit data are available for 1699 of these actions, and Figure 3 shows payback period information for these.

Table A3 in Appendix A shows that 1438 actions have a payback period of three years or less (with an average of 10 months), while 261 actions have a payback period of more than three years (average 10 years).

The average for the latter group is heavily influenced by a small number of expensive actions with very long payback periods. Although these actions were not required to be implemented by the program, the companies included them in their action plans on a business as usual basis. These actions contribute a total of 137 kt CO<sub>2</sub>-e/yr to the end 2007 program outcome, or about 11 per cent of the program total.

Of more significance is that over one-third (581) of the 1699 costed actions have payback periods of less than six months, and these actions achieve GHG reductions of 314 kt CO<sub>2</sub>-e/yr, or 25 per cent of the program total. These easy actions provide over \$18 million per year of cost savings to the companies involved.

**Site-based GHG reductions achieved.**

Figure 4 shows a distribution of the number of sites achieving various GHG reductions, expressed as percentages of the site's energy-related GHG emissions and as percentages of the site's total GHG emissions. It can be seen that half of the 311 sites reduced their GHG emissions by four per cent or less, while about one quarter of sites achieved a GHG reduction of 10 per cent or more.

Table A4 in Appendix A provides more detailed information about site-based GHG percentage reductions.

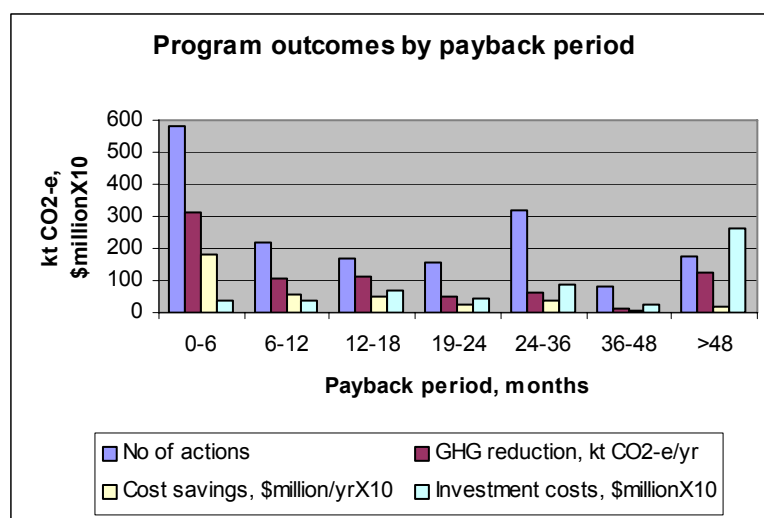


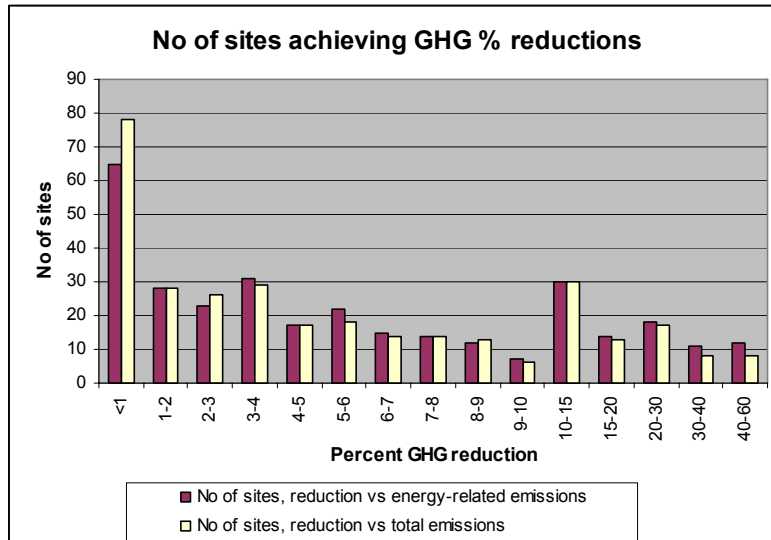
Figure 3: Payback periods for actions to be completed at end 2007

**Fuel usage reductions**

Table 5 shows the reductions in usage of various fuels that result from the program. The table provides data for all actions expected to be completed by the end of 2007. In each case, the actions already completed (end 2006) contribute about 75 per cent of the 2007 total.

The electricity reduction of 1166 TJ/yr is the same as 324 GWh of electricity, or an average of 37 MW of electricity demand for the year. This represents about 0.6 per cent of Victoria's annual electricity use (54000 GWh).

Similarly, the natural gas usage reduction of 5338 TJ represents about 2.3 per cent of Victoria's annual usage (230 PJ).



**Figure 4: End 2007 greenhouse gas reductions as percent of 2003 site emission.**

**Table 5: Reductions in usage of various fuels, end 2007.**

Fuel type	No. of actions	GHG reduction from actions, end 2007, kt CO <sub>2</sub> -e/yr	Energy reduction from actions, end 2007, TJ/yr	Annual cost savings, \$million/yr	Total investment costs, \$million
Electricity	1579	467	1166	17.6	33.1
Natural gas	386	341	5338	11.9	17.4
Diesel	34	8	120	2.4	4.3
Other fuel	21	148		1.1	2.3
Fuel not stated	416	262		5.2	7.4
<b>Total IGP actions</b>	<b>2436</b>	<b>1226</b>	<b>6623</b>	<b>38.2</b>	<b>64.6</b>

Current five-year forecasts indicate that Victoria's annual electricity demand growth is 0.5 per cent<sup>10</sup> and the annual gas demand growth (medium economic growth scenario) is 0.8 per cent<sup>11</sup>.

The reductions achieved through the IGP represent deferrals in demand growth for electricity and gas of approximately one year and three years, respectively. This significantly defers the need for investment in new electricity generation, and gas production and processing, capacity and associated distribution infrastructure. These investment deferrals provide a substantial but unquantified benefit to the State.

#### Industry sector analysis

Figures 5 and 6 show the costs and benefits of program actions for various industry sectors, defined according to the EPA scheduled premises categories<sup>12</sup> and the ANZSIC categories<sup>13</sup> respectively.

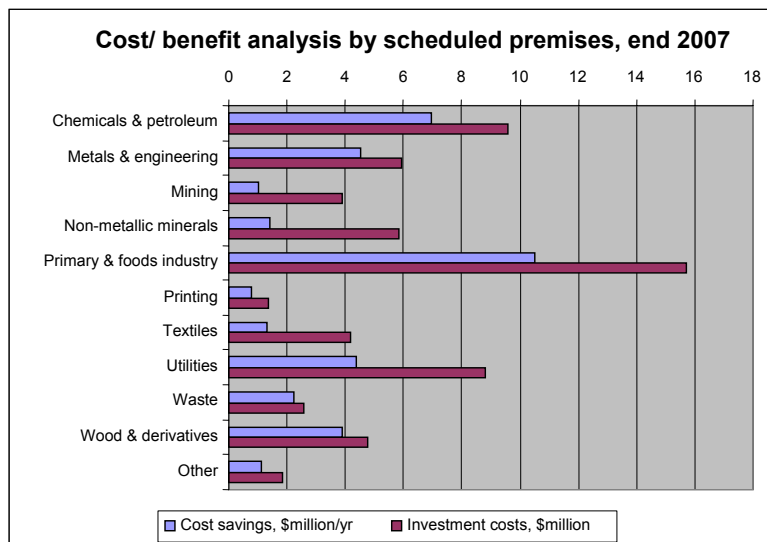
The average payback period can be determined by comparing the length of the cost bar and the length of the savings bar, and for a number of sectors is between 12 and 18 months. However it can also be seen that the mining, non-metallic minerals and textiles sectors required significantly longer to achieve payback.

Other sector-based data is provided in Tables A5 and A6 of Appendix A, where it can be seen that the investment cost per tonne of GHG reduction achieved was also higher for those three sectors than for others, the range for various sectors being from less than 20 to several hundred dollars per t CO<sub>2</sub>-e/yr reduction achieved.

#### Action type analysis

Figure 7 shows the contribution of various action types to the program. It can be seen that the largest number of actions related to energy management, while energy management and process modifications made up most of the energy-related greenhouse gas reductions. Both of these were exceeded by the contribution of non-energy related actions in the amount of GHG reduction achieved.

Of the common plant areas that are usually expected to provide opportunities for energy reductions, the most prominent were boilers and steam systems, motors and drives, and compressed air systems. There were also a large number of lighting actions undertaken, but the total GHG reduction from these was not as significant.



**Figure 5: Sectoral analysis of outcomes, end 2007 (EPA scheduled premises categories).**

<sup>10</sup> See VENCORP (2006a).

<sup>11</sup> See VENCORP (2006b).

<sup>12</sup> See State of Victoria (2007).

<sup>13</sup> See ABS (2006).

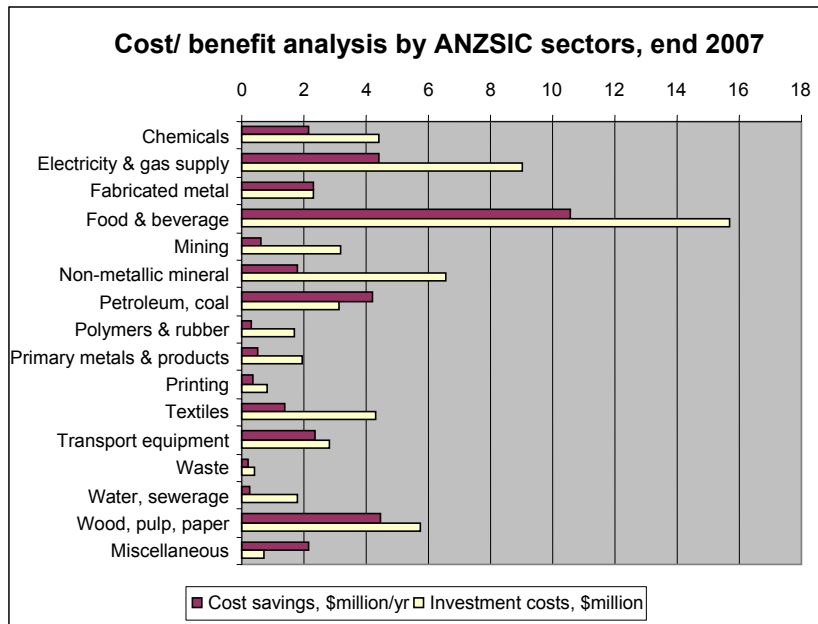


Figure 6: Sectoral analysis of outcomes, end 2007 (ANZSIC categories).

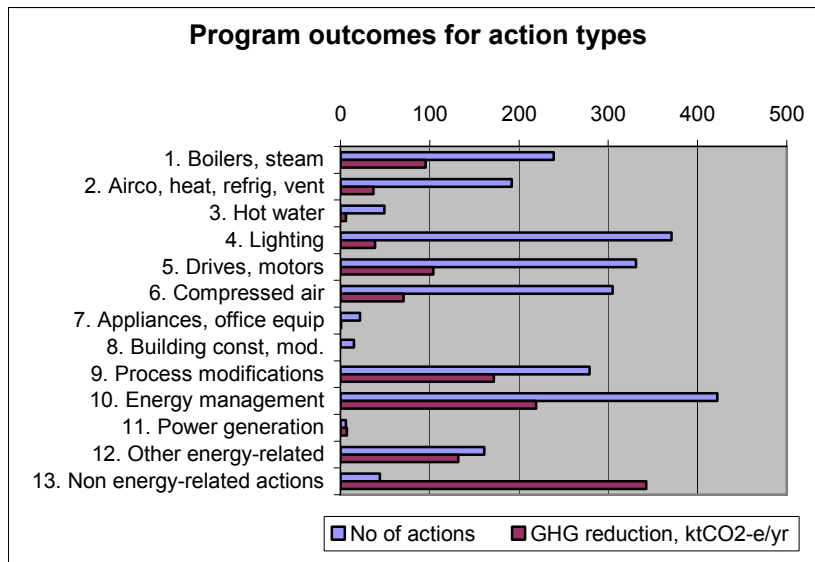


Figure 7: Analysis of outcomes by action type, end 2007.

Detailed program outcomes for various action types are shown in Table A7 in Appendix A. This includes cost and savings information for the various action types, and shows that:

- the best average payback period (8 months) was achieved by hot water system actions, but these had a small GHG reduction
- energy management systems and boilers/ steam systems achieved good payback periods (14 and 15 months) and these action types each achieved cost savings of over \$7 million per year
- the largest GHG reductions per unit of investment were achieved by non-energy related actions (e.g. landfill gas collection and reuse), and energy management and compressed air system actions. Power generation actions were also effective, but the small number of these actions may give a misleading conclusion.

### Compliance costs

The total investment cost for IGP actions was \$49.6 million at end 2006 and is expected to be \$64.6 million at end 2007. This includes costs associated with implementing the actions taken under the program. Other program compliance costs include:

- administration, data gathering and making submissions to EPA
- auditing of sites
- progress and annual reporting to EPA.

Information provided about audit costs for 156 sites indicates that the total cost for energy audits was in the order of \$1.8 million. This is heavily influenced by one site, which reported an audit cost of \$340,000,

whereas the next highest reported cost was \$68,000. It is estimated that the total audit cost for the 345 sites with approved action plans may have been \$3 to \$4 million, or a little over five per cent of the cost for implementation of actions.

A small number of sites indicated their own staff time associated with the auditing process, this varying from one day for a relatively small site to three months for a large and complex site. Several relatively large sites indicated staff time of two to four weeks.

The overall audit costs have little influence on the average payback period for actions taken under the program, although for sites with few feasible actions it could be more significant.

Administrative and reporting costs associated with the program were not gathered.

### Works approvals

Figure 8 shows the number of works approvals issued between July 2002 and December 2006 for each industry sector, together with the number actually built (or still under construction) and the cost of works for these.

EPA has assessed and issued 336 works approvals in that period, of which 120 projects did not proceed. The 216 projects that have been built or are still under construction have a total value of over \$2 billion.

The PEM requires applicants to demonstrate that best-practice measures in relation to energy efficiency and greenhouse gas emissions are incorporated into these projects, so it is clear that the program has had the ability to influence the impact of significant numbers of projects.

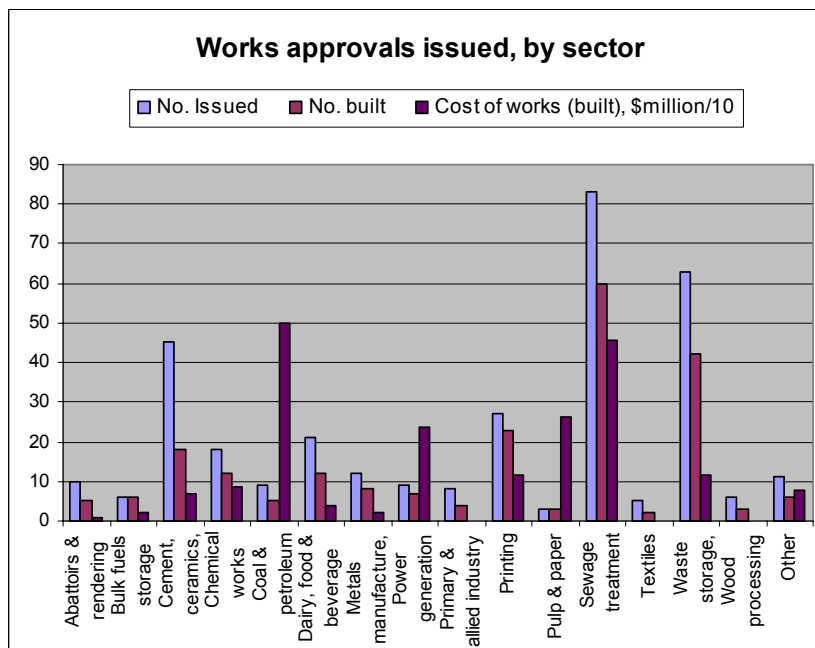


Figure 8: Works approvals processed by sector, July 2002 to December 2006

The way in which works approval applications deal with the energy and greenhouse requirements has improved considerably since the PEM came into force and assessment guidelines were issued. Applicants have given more thought to the best-practice requirements and have taken steps to demonstrate that suitable measures are incorporated into their proposals.

Examples of these measures include the following:

- After discussions with EPA, a regional water authority revised its original proposal for a new sewage treatment plant to include the use of energy-efficient pumping equipment, thereby achieving lower operating costs and reducing the energy-related GHG emissions from the plant operations.
- A gas processing plant was able to reduce the fuel usage of a gas turbine compressor by using a level of emission control that was appropriate to the likely air quality impacts in the surrounding environment, thereby reducing its GHG emissions and achieving the most balanced environmental outcome.

Table A8 in Appendix A provides more detail about the assessment of works approvals within the relevant period.

## 6. ASSESSMENT OF THE IMPACTS OF THE PROGRAM

### Financial impacts on industry

As shown in chapter 5, the program has provided a significant financial benefit to participating companies. The average payback period for actions taken under the program is 20 months, with annual cost savings of \$38 million being achieved.

The total GHG reduction of 1.23 Mt CO<sub>2</sub>-e per annum will place industry in a better position should a carbon price be established in Australia. Had these reductions not occurred before the introduction of such a carbon price mechanism, industry would have faced a proportionally higher cost. As an estimate of the cost avoided, the current price of carbon (one tonne of CO<sub>2</sub>-e) in the European Union Emissions Trading Scheme is EU21.15 (A\$33) for the 2008 settlement period<sup>14</sup>, while in the New South Wales Greenhouse Gas Abatement Scheme the wholesale market price at 31 May 2007 was A\$14.30 per tonne<sup>15</sup>. The GGAS scheme penalty rate for shortfalls is A\$11.00 per tonne<sup>16</sup>, which effectively limits market prices to around that amount,

<sup>14</sup> See Point Carbon (2007).

<sup>15</sup> See Carbon Planet (2007).

<sup>16</sup> See GGAS (2007).

## Industry Greenhouse Program business outcomes

### Murray Goulburn Co-operative

Establishing an Energy Management Team, the largest milk processor in Australia showed how shared learning and focused action plans could save over five million dollars per year across its eight sites.

A sizable amount of these savings can be attributed to common actions such as installing variable-speed drives, fixing steam leaks and changing heating and cooling cycles, whilst similarities between its plants allowed the company to copy successful energy-saving actions at a number of sites. For example, compressed air systems at Cobram, Leongatha and Kiewa plants now have energy-saving electronic drain valves, and heat is now recovered from whey production at the Leongatha and Kiewa plants.

Other projects included converting trucks to more energy-efficient fuels such as liquefied natural gas, and an innovative steam turbine project.

'The Industry Greenhouse Program gives you a very good understanding of your internal processes. The audit process identified issues we may not have seen otherwise. You can work out which processes are running inefficiently and clearly see what you can do to improve them.'

Julian Leitch, Energy Team Member, Leongatha

#### Key points

Reduction in energy costs	Approx. \$5.5 million per year
Reduction in GHG emissions	51,153 tonnes of CO <sub>2</sub> -e per year (equivalent to taking 11,896 cars off the road)

#### Return on investment

Recovery of investment costs: 1 year

### Toyota, Altona

One of Toyota's recent major energy reduction projects has been to decommission a paint shop's topcoat afterburner used to reduce paint shop odours. Changing the paint formulation, reducing the amount of paint required and minimising overspray reduced odours and eliminated the need for the afterburner. Toyota has also been working to reduce its greenhouse impact beyond the factory gate by reducing the fuel consumption of the vehicles it manufactures, shifting some of its interstate deliveries from road to rail and increasing environmental awareness amongst its dealers.

#### Key points

Reduction in energy costs	Approx. \$600,000 per year
Reduction in GHG emissions	13,760 tonnes of CO <sub>2</sub> -e per year (equivalent to 982 average households)

#### Return on investment

Recovery of investment costs: Less than 1 year

with the small premium that is evident in market prices probably attributable to a desire to maintain 'goodwill'.

The total program GHG reduction of 1.23 Mt CO<sub>2</sub>-e/yr is therefore equivalent to an avoided carbon cost of between A\$13.5 million and A\$40.6 million. This can be seen as an additional benefit to the \$38.2 million annual energy cost saving achieved by the actions taken under the program.

The program influenced a number of companies to establish energy monitoring and management systems, which will better inform them of their energy use and their associated carbon emissions. This will improve their ability to track energy use and identify improvement opportunities, and so enhance their capacity to deal with a carbon price mechanism such as the proposed emissions trading scheme.

### Client feedback

All category C clients were asked to provide feedback about the program by completing a basic questionnaire. 188 questionnaires were returned (out of about 300 clients), with 145 to 179 responses provided to each of six questions. The questions asked were:

1. Did you find the SEPP energy audit has made you any more aware of your energy use within the business?
2. How valuable did you find the preparation of an energy use and GHG emissions inventory?
3. How valuable did you find the benchmarking of energy use/GHG emissions measured against production indicators?
4. How valuable did you find the recommendations for energy saving items?
5. Have you found that implementing the action plan item had a noticeable effect on your energy bills?
6. Do you have any system in place to monitor energy use?

A summary of the questionnaire responses is provided in Figure 9, while statistics are provided in Table A9 of Appendix A.

It was notable from the survey responses that:

- All questions except Q5 received a positive majority answer (yes, valuable or very valuable). A number of respondents to Q5 indicated that it was hard to determine if bills had been reduced by the actions taken. Other factors such as increased production rates or changes in the product mix can have a confounding effect.
- Questions 1, 2 and 3 received a number of 'not valuable' responses from clients who already had energy monitoring systems and benchmarking processes in place. The inherent value of these approaches to energy management was obviously supported by these clients.

## Industry Greenhouse Program business outcomes

### Godfrey Hirst, Geelong

In pursuit of environmental excellence beyond its already impressive track record in water management, Godfrey Hirst now tackles energy efficiency.

Production-line processes continue to be improved, including the removal of unnecessary vacuum pumps on dye lines, modification of compressed air pressure, replacement of redundant boiler economisers, and condensate return lines installed on appropriate equipment.

Godfrey Hirst has continued its development of synthetic coloured yarn and integrated it with high-tech tufting machines to develop carpet that does not require dyeing or drying, thereby reducing energy consumption required per metre of carpet produced.

'We are looking for more opportunities to improve our business and environmental performance. Through cleaner production processes we hope to replicate the achievements we have made at Geelong South at our other manufacturing sites.'

Tim Maishman, Group Operations Manager

#### Key points

Reduction in energy costs	Approx. 10%
Reduction in GHG emissions	3981 tonnes of CO <sub>2</sub> -e per year (equivalent to taking 925 cars off the road)

#### Return on investment

Recovery of implementation costs: 2.2 years

### Holden, Fishermans Bend

In 2003 the Fishermans Bend plant of GM Holden established an energy reduction target of 10 per cent and indicators suggest it will achieve this goal in 2007.

In an endeavour to maximise energy efficiency a number of sophisticated computerised energy monitoring systems have been put in place to optimise the energy efficiency of the furnaces and compressed air distribution plants. It is now time to focus on the next steps in the resource efficiency process. The most significant gains can be seen as a result of improved management and streamlining of compressed air systems. Almost 75 per cent of greenhouse gas emission reductions can be attributed to this action alone. Improvements made to the compressed air system in Plant 18 (where the Global V6 engine is manufactured) have eliminated unnecessary compressed air loss and this project alone resulted in savings of over \$700,000 with a payback on investment of less than one year.

#### Key points

Reduction in energy costs	Approx. \$946,000 per year
Reduction in GHG emissions	11,597 tonnes of CO <sub>2</sub> -e per year (equivalent to 828 average households)

#### Return on investment

Recovery of investment costs: 11 months

Fifteen clients were then interviewed and asked to provide some more detailed responses. These clients represented a range of industry sectors, site size and

Chart All Regions : Total Number of Samples

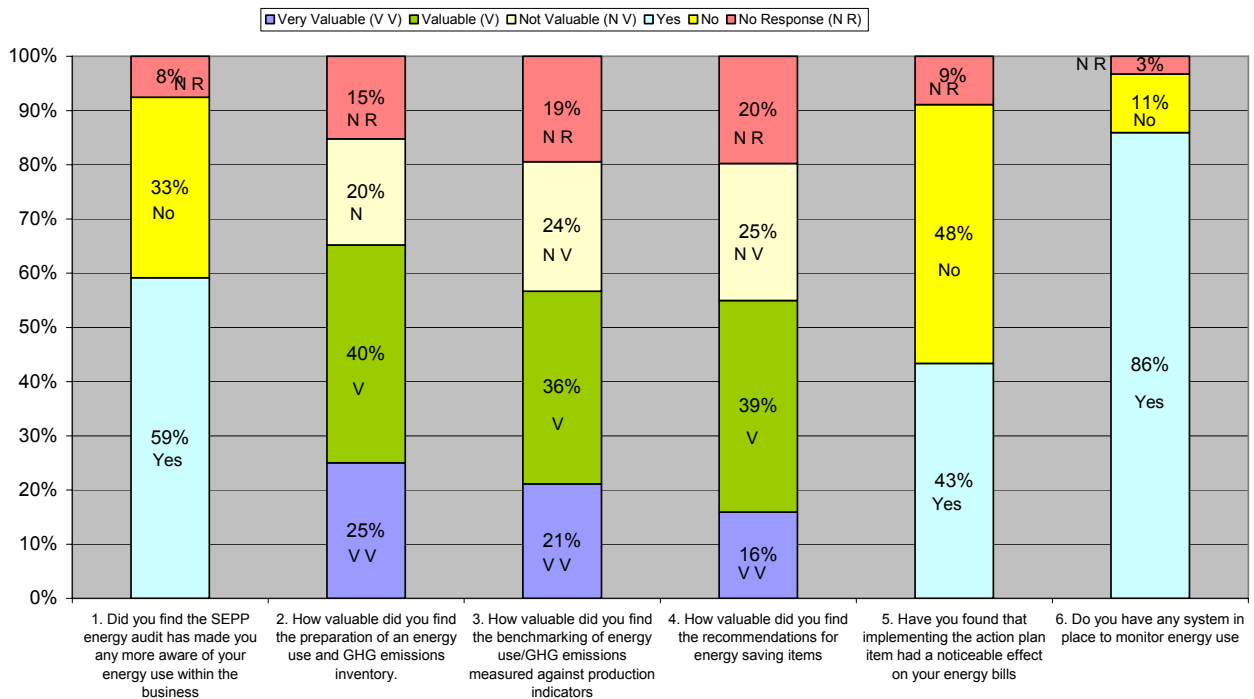


Figure 9: Client feedback survey – summary of responses.

complexity, and geographic locations. Some key points arising from these interviews were as follows:

- A number of clients were not satisfied with the recommendations provided by external energy auditing consultants. This related to two main factors: the accuracy of cost/benefit calculations and the feasibility of recommendations that could have impacted on product quality or plant safety. In most cases these outcomes were the result of inadequate collaboration between the consultants and the company's on-site staff during the audit process and in reviewing draft recommendations.
- One large company reduced its energy audit cost from \$250,000 (quoted by an external consultant) to about \$20,000 by using an internal team of experienced staff. The internal staff time involved was significant at an estimated 1500 hours, but the company was able to achieve an excellent outcome. Not all companies have the ability to apply internal resources to this task, but this case demonstrates the potential benefit when sufficient internal expertise exists. At a minimum, companies need to provide sufficient assistance to ensure that recommendations are appropriate and feasible.
- A number of the interviewed companies said that the energy-reduction actions taken were 'business as usual' or were consistent with their normal energy management approaches, while others

went 'beyond compliance' with longer-term payback actions for strategic business reasons. Some simply complied with the PEM by undertaking those actions with payback periods of three years or less, but said that they would not have otherwise done so.

- Some companies affiliated with other programs (such as Greenhouse Challenge Plus<sup>17</sup>) were aware of feasible opportunities but had not scheduled their implementation until required to do so by the EPA program.
- Barriers to implementation of recommended actions included:
  - cost increases when firm quotes were sought
  - technical problems with installation
  - 'impracticality' of actions
  - competing priorities for staff time
  - competing priorities for funding
  - undesirable OH&S or product quality impacts
  - scheduling of plant shutdowns that may be needed for implementation
  - process or operations changes that make actions redundant.

<sup>17</sup> See AGO (2005).

- Many companies indicated that the program had increased employee awareness of energy and greenhouse issues, and that employee suggestions for energy savings were still coming forward. One finance manager commented that he had previously thought that environmental projects only cost, not saved, money.
- The interviewed companies made various suggestions to improve the program or to be considered for future programs, including:
  - for those involved in other programs, the use of streamlined systems to simplify their reporting to multiple government agencies
  - the development of a register of approved external auditing consultants
  - the use of standardised accounting procedures for the calculation of payback periods
  - the use of flexible auditing approaches that would make more use of internal expertise
  - the consideration of a company's market and operating constraints in mandating the implementation of actions.

EPA is using this feedback to help develop its future resource efficiency programs.

## 7. WHERE TO FROM HERE? CONTINUING OBLIGATIONS AND FUTURE PROGRAM

### Continuing obligations

The IGP continues to have ongoing requirements for EPA licence holders and works approval applicants.

Licence holders are required to continue to report to EPA annually on their energy use and GHG emissions, together with improvement actions taken in the last year or planned for the next year.

Applicants for EPA works approval must continue to comply with the PEM requirements described in Chapter 4. Where the proposed works will use more than the threshold amount of energy, best-practice energy efficiency measures must be identified and used in the works. Best-practice measures must also be applied in relation to any GHG emissions that may be generated by the proposed works. These details are explained in EPA Victoria (2006b).

### Future program – Environment and Resource Efficiency Plans

Based on the success of the Industry Greenhouse Program, EPA is developing a new program called Environment and Resource Efficiency Plans (EREP). The EREP program was enabled by legislative amendments in the *Environment Protection (Amendment) Act 2006*<sup>18</sup>, and details of the program

<sup>18</sup> See State of Victoria (2006).

## Industry Greenhouse Program business outcomes

### Alpine MDF Industries, Wangaratta

Thinking outside the square enabled Alpine MDF to reduce the company's annual energy costs by 12 per cent on average, with one project saving \$250,000 per year with a payback period of less than a month.

'By taking a team approach you can tap into considerable knowledge and experience to come up with smart, very cost-effective ideas. They not only have environmental benefits – they help the company's bottom line and often have OH&S and other benefits. To stay profitable you have to keep looking for opportunities to improve.'

Graham Church, CEO, Alpine MDF

The site energy audit identified that significant reductions could be realised by upgrading the seven-year-old, energy-intensive refiner (which grinds woodchips into fibre) with a more efficient model, but the high price and long payback period initially placed the project outside of the Industry Greenhouse Program implementation requirements.

The company's team environment fosters the discussion of approaches to achieve annual environmental improvement targets and challenges and this resulted in the Technical and Engineering Departments collaborating to propose a new, equally effective solution. The refiner plates were replaced at a capital cost of \$17,000, with minimum downtime and an annual energy saving of \$250,000 and greenhouse gas reduction of 7335 tonnes CO<sub>2</sub>-e per annum. Even though this initiative requires some additional resources to monitor the fibre production it had a payback time of less than one month and was shown to save on average 12 per cent of the company's annual energy costs.

#### Key points

Reduction in energy costs	Approx. \$300,000 per year
Reduction in GHG emissions	9471 tonnes of CO <sub>2</sub> -e per year (equivalent to taking 2202 cars off the road)

#### Return on investment

Recovery of investment costs: 3 months

### Ford Australia, Broadmeadows

While optimising energy efficiency has been an ongoing activity for Ford across all of its Australian sites since the early 1990s, recent results from the Broadmeadows plant have been notable. Focusing on the paint line air compressors and the boiler house air compressor contributed most significantly to the final results. Maintenance and leak detection, as well as ensuring that the most efficient compressor is used for the task (on demand), provided almost half of the energy cost savings at a cost of less than \$13,000. More than 60% of the site's greenhouse gas emission reductions were attributed to these actions.

#### Key points

Reduction in energy costs:	Approx. \$248,600 per year
Reduction in GHG emissions	5617 tonnes of CO <sub>2</sub> -e per year (equivalent to 401 average households)

#### Return on investment

Recovery of investment costs: 15 months

requirements are currently being developed through Regulations and associated guidelines. These will be released for consultation in late 2007. The EREP program is expected to commence in January 2008.

The EREP program recognises the need for, and potential benefits to be obtained by, improvements in resource efficiency and waste generation. It will apply to large energy and water users, and will require participants to address their energy use, water use and waste generation and disposal rates.

An industrial or commercial site at which energy and/or water use exceeds threshold levels defined in the proposed EREP Regulations will be required to:

- after conducting a self-assessment of energy and water usage, and waste generation and disposal, register for the program with EPA;
- undertake assessments of energy, water and waste at the site and identify cost effective opportunities to improve resource efficiency;
- submit an EREP to EPA, in which the cost-effective opportunities are detailed and timelines for implementation are outlined;
- after approval of the EREP, undertake the actions and provide periodic reports of progress to EPA.

The EREP process is expected to be completed on a regular cycle for each participating site.

Sites that are involved with other similar government or voluntary programs may apply for recognition of the actions being taken and EPA may issue a whole or partial exemption if it is satisfied that these actions satisfy the requirements of the EREP program.

Sites that do not meet the defined energy and water use thresholds for the EREP program may participate on a voluntary basis.

Many of the issues raised in feedback about the Industry Greenhouse Program (see chapter 6) have been considered in developing the EREP program.

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## APPENDIX A – DETAILED TABLES OF PROGRAM ACHIEVEMENTS

**Table A1: Summary of baseline energy use by IGP sites, 2003.**

Site energy use range, TJ	No. of sites	Total energy use for sites in range, TJ/yr	Energy-related GHG emissions for sites in range, kt CO <sub>2</sub> -e/yr
> 10,000	5	78,417	14,322
1,000 to 10,000	21	52,819	9,752
500 to 1,000	25	17,143	2,401
200 to 500	41	12,537	1,850
100 to 200	48	7,081	1,024
50 to 100	36	2,640	424
20 to 50	54	1,701	284
10 to 20	50	708	125
7 to 10	25	211	49
0.5 to 7	239	534	123
< 0.5	233	32	8
<b>Total</b>	<b>777</b>	<b>173,823</b>	<b>30,362</b>

**Table A2: Summary of GHG emissions by IGP sites, 2003.**

Site total GHG emission range, kt CO <sub>2</sub> -e/yr	No. of sites	Total GHG emissions for sites in range, kt CO <sub>2</sub> -e/yr	Energy-related GHG emissions for sites in range, kt CO <sub>2</sub> -e/yr
> 10,000	3	48,677	4,513
2,000 to 10,000	3	21,732	11,896
1,000 to 2,000	4	5,891	2,663
500 to 1,000	4	2,927	2,888
200 to 500	6	1,646	1,276
100 to 200	20	2,943	2,430
50 to 100	31	2,280	1,810
20 to 50	69	2,140	1,662
10 to 20	47	684	603
5 to 10	40	299	287
2 to 5	67	210	190
1 to 2	49	72	65
0.5 to 1	57	40	38
0.2 to 0.5	85	27	26
0.1 to 0.2	56	8	7
< 0.1	236	7	7
<b>Total</b>	<b>777</b>	<b>89,584</b>	<b>30,362</b>

**Table A3: Payback periods for actions to be completed at end 2007.**

Payback period	No. of actions	Total annual GHG reductions, kt CO <sub>2</sub> -e/yr	Total annual energy cost savings, \$million/yr	Total investment costs, \$million
0 to 6 months	581	314	18.2	3.6
7 to 12 months	218	105	5.4	4.0
13 to 18 months	167	115	5.0	6.6
19 to 24 months	154	52	2.5	4.6
25 to 36 months	318	62	3.5	8.8
37 to 48 months	84	15	0.7	2.6
More than 48 months	177	122	2.1	26.0
<b>3 years or less</b>	<b>1438</b>	<b>648</b>	<b>34.6</b>	<b>27.6</b>
<b>More than 3 years</b>	<b>261</b>	<b>137</b>	<b>2.8</b>	<b>28.6</b>

**Table A4: Percent GHG reduction achieved, end 2007.**

GHG reduction, % of 2003 baseline	No. of sites with IGP GHG reduction as percentage of baseline energy-related emissions	No. of sites with IGP GHG reduction as percentage of baseline total site emissions
0.0 to 0.9%	65	78
1.0 to 1.9%	28	28
2.0 to 2.9%	23	26
3.0 to 3.9%	31	29
4.0 to 4.9%	17	17
5.0 to 5.9%	22	18
6.0 to 6.9%	15	14
7.0 to 7.9%	14	14
8.0 to 8.9%	12	13
9.0 to 9.9%	7	6
10.0 to 14.9%	30	30
15.0 to 19.9%	14	13
20.0 to 29.9%	18	17
30.0 to 39.9%	11	8
>40.0%	12	8

Table A5: Analysis of outcomes by sector, end 2007 (EPA scheduled premises categories).

Sector description	No. of sites	GHG reduction from actions, end 2007, kt CO <sub>2</sub> -e/yr	Annual cost savings, \$million/yr	Total investment, \$million	Average payback period, months	Investment cost per tonne CO <sub>2</sub> reduction achieved, \$	Overall percent CO <sub>2</sub> -e reduction <sup>1</sup>
Chemicals & petroleum	54	264	7.1	9.7	16	37	9.9%
Metals & engineering	27	135	4.5	5.9	16	44	1.3%
Mining	13	10	1.0	3.9	47	390	10.9%
Non-metallic minerals	19	36	1.4	5.8	50	161	3.4%
Primary, animal by-products & food	64	134	10.5	15.7	18	117	6.6%
Printing	14	22	0.8	1.4	21	64	7.2%
Textiles	11	15	1.3	4.2	39	280	7.8%
Utilities	22	304	4.4	8.8	24	29	n/a <sup>2</sup>
Waste	80	135	2.2	2.6	14	19	n/a <sup>2</sup>
Wood & derivatives	6	148	3.9	4.8	15	32	9.5%
Other	11	22	1.1	1.8	20	82	7.4%
<b>Total</b>	<b>321</b>	<b>1226</b>	<b>38.2</b>	<b>64.6</b>	<b>20</b>	<b>53</b>	

Notes. 1. Total GHG reduction as percent of total GHG emissions.  
2. Non-energy related emissions and reductions influence this sector result.

Table A6: Analysis of outcomes by sector, end 2007 (ANZSIC categories).

ANZSIC Division/ Subdivision	No. of sites	GHG reduction from actions, end 2007, kt CO <sub>2</sub> -e/yr	Annual cost savings, \$million/yr	Total investment, \$million	Average payback period, months	Investment cost per tonne CO <sub>2</sub> reduction achieved, \$	Overall percent CO <sub>2</sub> -e reduction <sup>1</sup>
B. Mining	13	8	0.6	3.2	61	373	12.0%
C. Manufacturing							
C11/12. Food & beverage	62	133	10.5	15.7	18	118	6.6%
C13. Textiles	15	16	1.4	4.3	37	263	6.6%
C14/15. Wood, pulp & paper products	14	167	4.5	5.7	15	34	9.2%
C16. Printing	7	7	0.4	0.8	28	110	7.8%
C17. Petroleum & coal products	8	206	4.2	3.1	9	15	12.6%
C18. Basic chemical & chemical products	28	51	2.1	4.4	25	86	4.0%
C19. Polymer & rubber products	9	3	0.3	1.7	63	660	1.6%
C20. Non-metallic mineral product	20	38	1.8	6.6	44	174	3.4%
C21. Primary metals & products	9	26	0.5	2.0	44	74	0.6%
C22. Fabricated metal products	14	65	2.3	2.3	12	36	6.2%
C23. Transport equipment manufacturing	8	53	2.4	2.8	14	53	6.4%
D. Electricity, Gas, Water & Waste							
D26/27. Electricity & gas supply	26	312	4.4	9.0	25	29	n/a <sup>2</sup>
D28. Water, sewerage & drainage	40	6	0.3	1.8	81	310	n/a <sup>2</sup>
D29. Waste disposal	29	118	0.2	0.4	21	3	n/a <sup>2</sup>
Miscellaneous	19	14	2.1	0.7	4	49	7.9%
<b>Total</b>	<b>321</b>	<b>1226</b>	<b>38.2</b>	<b>64.6</b>	<b>20</b>	<b>53</b>	

Notes. 1. Total GHG reduction as percent of total GHG emissions.  
2. Non-energy related emissions and reductions influence this sector result.

Table A7: Analysis of outcomes by action type, end 2007.

Action type	No of actions	GHG reduction from actions, end 2007, kt CO <sub>2</sub> -e/yr	Annual cost savings, \$million/yr	Total investment, \$million	Average payback period, months	Investment cost per tonne CO <sub>2</sub> reduction achieved, \$
1. Boilers & steam systems	239	95	7.0	8.0	14	84
2. Air conditioning/ heating/ refrigeration/ ventilation	192	37	2.2	3.0	17	82
3. Hot water systems	49	6	0.7	0.5	8	82
4. Lighting	371	39	1.0	3.6	45	94
5. Plant drives/ motors	331	104	4.5	11.5	30	110
6. Compressed air	305	71	3.2	3.6	14	51
7. Appliances & office equipment	22	1	<0.1	0.2	37	181
8. Building construction/ modification	15	1	<0.1	0.1	51	134
9. Process modifications	279	172	5.9	16.0	33	93
10. Energy management	422	219	7.3	9.0	15	41
11. Power generation	6	7	0.1	0.1	11	13
12. Other energy-related actions	161	132	3.7	5.1	17	38
13. Non energy-related actions	44	343	2.6	4.0	19	12

**Table A8: Works approvals issued by industry sector, July 2002 to December 2006.**

Industry sector	No. of approvals issued	No. of works built	Total cost of works approved \$million	Total cost of works built \$million
Abattoirs & rendering	10	5	657	7
Bulk fuels storage	6	6	23	23
Cement, ceramics, concrete & bitumen batching	45	18	155	71
Chemical work	18	12	157	88
Coal & petroleum processing	9	5	632	501
Dairy, food & beverage	21	12	51	40
Metals manufacture, processing & finishing	12	8	108	23
Power generation	9	7	247	237
Primary & allied industry	8	4	18	2
Printing	27	23	125	115
Pulp & paper	3	3	262	262
Sewage treatment	83	60	496	457
Textiles	5	2	3	1
Waste storage, treatment, landfill, composting	63	42	133	117
Wood processing	6	3	2	1
Other	11	6	83	77
<b>TOTAL</b>	<b>336</b>	<b>216</b>	<b>2,560</b>	<b>2,022</b>

**Table A9: Client feedback survey – summary of responses.**

Question	1. Did you find the SEPP energy audit has made you any more aware of your energy use within the business?	2. How valuable did you find the preparation of an energy use and GHG emissions inventory?	3. How valuable did you find the benchmarking of energy use/GHG emissions measured against production indicators?	4. How valuable did you find the recommendations for energy saving items?	5. Have you found that implementing the action plan item had a noticeable effect on your energy bills?	6. Do you have any system in place to monitor energy use?
<b>Response</b>						
Very valuable		46 (25%)	38 (21%)	29 (16%)		
Valuable		74 (40%)	64 (36%)	71 (39%)		
Not valuable		36 (20%)	43 (24%)	46 (25%)		
Yes	110 (59%)				78 (43%)	159 (86%)
No	62 (33%)				86 (48%)	20 (11%)
No response	14 (8%)	28 (15%)	35 (19%)	36 (20%)	16 (9%)	6 (3%)
<b>TOTAL</b>	<b>186 (100%)</b>	<b>184 (100%)</b>	<b>180 (100%)</b>	<b>182 (100%)</b>	<b>180 (100%)</b>	<b>185 (100%)</b>