

---

The Allen Consulting Group

# **Economic Impacts of a National Energy Efficiency Target**

Simulations Using the Monash MMRF-Green Model

April 2004

Report to Sustainable Energy Authority of Victoria

---

# The Allen Consulting Group

The Allen Consulting Group Pty Ltd

ACN 007 061 930

## Melbourne

---

4th Floor, 128 Exhibition St

Melbourne VIC 3000

Telephone: (61-3) 9654 3800

Facsimile: (61-3) 9654 6363

## Sydney

---

3rd Floor, Fairfax House, 19 Pitt St

Sydney NSW 2000

Telephone: (61-2) 9247 2466

Facsimile: (61-2) 9247 2455

## Canberra

---

Level 12, 15 London Circuit

Canberra ACT 2600

GPO Box 418, Canberra ACT 2601

Telephone: (61-2) 6230 0185

Facsimile: (61-2) 6230 0149

## Perth

---

Level 25, 44 St George's Tce

Perth WA 6000

Telephone: (61-8) 9221 9911

Facsimile: (61-8) 9221 9922

## Brisbane

---

Level 11, 77 Eagle Street

Brisbane QLD 4000

Telephone: (61-7) 3221 7266

Facsimile: (61-7) 3221 7255

## Online

---

Email: [allcon@allenconsult.com.au](mailto:allcon@allenconsult.com.au)

Website: [www.allenconsult.com.au](http://www.allenconsult.com.au)

## Disclaimer:

While The Allen Consulting Group endeavours to provide reliable analysis and believes the material it presents is accurate, it will not be liable for any claim by any party acting on such information.

© The Allen Consulting Group 2003

---

## Acronyms and Abbreviations

AEEI	autonomous energy efficiency improvement
AGO	Australian Greenhouse Office
CGE	computable general equilibrium
CoAG	Council of Australian Governments
CoPS	Centre of Policy Studies (Monash University)
CO <sub>2</sub> -e	carbon dioxide–equivalent
EEC	Energy Efficiency Certificate
EEl	energy efficiency improvement
EEWG	MCE Energy Efficiency Working Group
GHG	greenhouse gas
GJ	gigajoule
MRET	Mandatory Renewable Energy Target
MCE	Ministerial Council on Energy
Mt	Mega tonne
MWh	megawatt hour
NPV	net present value
SEAV	Sustainable Energy Authority Victoria
UNFCCC	United Nations Framework Convention on Climate Change

---

## Contents

<i>Acronyms and Abbreviations</i>	<i>iii</i>
<i>Executive summary</i>	<i>v</i>
Introduction	v
Main summary points	v
Conclusions and recommendations	vi
<hr/>	
Chapter 1	1
<i>Introduction</i>	<i>1</i>
1.1 Background	1
1.2 Objectives	1
<hr/>	
Chapter 2	2
<i>Modelling a National Energy Efficiency Target</i>	<i>2</i>
2.1 The NEET	2
2.2 The MMRF-Green Model	2
2.3 Modelling Inputs	2
2.4 Simulation design	4
2.5 NEET Scenarios	5
<hr/>	
Chapter 3	7
<i>Modelling Results</i>	<i>7</i>
3.1 Scenario 1: one per cent NEET	7
3.2 Scenario 2: one per cent target for Australia; slower ramp up rate	10
3.3 Scenario 3: 0.5 per cent target for Australia; fast ramp up rate	11
<hr/>	
Chapter 4	14
<i>Conclusions</i>	<i>14</i>
4.1 Key findings	14
<hr/>	
Appendix A	15
<i>Modelling Methodology</i>	<i>15</i>
A.1 Base case	15
A.2 Other assumptions	16
<hr/>	
Appendix B	18
<i>Inputs for the economic modelling</i>	<i>18</i>
B.1 Economic Modelling for NEET	18
B.2 Sectoral EEI potential estimates - methodology	20
B.3 Summary of Results for Refined Estimates	24
<hr/>	

## Executive summary

### Introduction

The Sustainable Energy Authority Victoria (SEAV) — through its involvement in the Ministerial Council on Energy's Energy Efficiency Working Group — is currently coordinating the development of a National Framework for Energy Efficiency. The purpose of the National Framework is to achieve a step change in Australia's energy efficiency, with the objective of unlocking the significant economic potential associated with increased implementation of energy efficient technologies and processes to deliver a least cost approach to energy provision in Australia.

### Project objectives

The Allen Consulting Group was engaged by SEAV to undertake an analysis of the impacts of a National Energy Efficiency Target (NEET), for targeted annual reductions in the end use consumption of energy. The analysis is intended to inform the development and introduction of a policy mechanism aimed at increasing the energy efficiency of different industries.

The analysis builds on earlier work undertaken by The Allen Consulting Group and the Monash Centre of Policy Studies for SEAV examining the potential returns to investments in energy efficiency.

### Main summary points

The Sustainable Energy Authority of Victoria has proposed the NEET to improve energy efficiency in end use applications.

### Results of Modelling

Table ES.1

#### SUMMARY DATA — NEET: NET PRESENT VALUE OF DEVIATIONS 2005 TO 2025

	Scenario 1 1% NEET Standard Ramp Up	Scenario 2 1% NEET Slow Ramp Up	Scenario 3 0.5% NEET Standard Ramp Up
Real private consumption (\$m)	8,449	7,555	4,091
Real investment (\$m)	2,023	2,009	1,020
Real GDP (\$m)	12,407	11,164	6,025
Employment increase ('000 persons in 2014)	1.9	2.1	0.9

Source: The Allen Consulting Group and Monash CoPS

The results of modelling a range of targets are presented in Table ES1. These are based on a NEET scheme operating for a 10-year period from 2005 to 2014, with an assumed life of the energy efficiency investments of 12 years. The modelling

simulations have been run out to 2025 to capture the full life of the energy savings investments undertaken during the NEET period. It is proposed that the NEET would be phased in at the start of the 10-year period and then phased out at the end. The standard profile for the NEET is based on a 3-year ramp up and 3-year ramp down. A slow ramp up of 5-years has also been modelled (Scenario 2).

Achieving annual energy savings of one per cent beyond 'business as usual' (a one per cent NEET) would deliver an increase in consumption of approximately 0.18 per cent by 2014 (\$1.0 billion), while reducing electricity prices to end users and saving 16.5 Mt CO<sub>2</sub>e of greenhouse gases. The total net present value of increased real consumption in the economy over the life of the investments initiated by a one per cent NEET is more than \$8 billion dollars (Scenario 1 in Table ES1).

Phasing in the one per cent NEET over 5 years rather than 3 years has only a limited impact on the overall results. Economic impacts are smaller to the extent that there is less take up of opportunities for cost effective investments in energy efficiency (Scenario 2 in Table ES1).

Finally, the results are reasonably linear to the amount of energy efficiency adopted, provided that the investments have paybacks of less than or equal to 4 years. Halving the size of the target roughly halves the size of the benefits over the life of the investments generated (Scenario 3 in Table ES1).

### **Conclusions and recommendations**

A range of significant national benefits — economic, social and environmental — could be derived from improving energy efficiency throughout the economy. The modelling of the economic impacts of improved energy efficiency in this report demonstrates the potential gains that are available — for economic growth, consumer welfare and employment, and for cost effective reductions in greenhouse gas emissions and energy usage.

The extent to which these gains are realised will depend on the effectiveness of policy in driving uptake of cost effective energy efficiency investments, while limiting transactions and compliance costs.

## Chapter 1

# Introduction

### 1.1 Background

The Ministerial Council on Energy (MCE), established by the Council of Australian Governments (CoAG) in June 2001, is the key intergovernmental body through which policies to encourage energy efficiency can be initiated and implemented. Through the Energy Efficiency Working Group (EEWG), the MCE seeks to enhance cooperative energy efficiency policies as one of its key activities.

The Sustainable Energy Authority Victoria (SEAV) — via its involvement in EEWG — is currently coordinating the development of a National Framework for Energy Efficiency. The purpose of the National Framework is to achieve a step change in Australia's energy efficiency with the objective of unlocking the significant economic potential associated with increased implementation of energy efficient technologies and processes to deliver a least cost approach to energy provision in Australia. Developing the National Framework will help identify areas and mechanisms for improved coordination and cooperation across jurisdictions in the delivery of energy efficiency policies and programs.

### 1.2 Objectives

The Allen Consulting Group was engaged by SEAV to undertake an analysis of the impacts of a National Energy Efficiency Target (NEET), for targeted annual reductions in end use consumption of energy. The analysis is intended to inform the development and introduction of a policy mechanism aimed at increasing the energy efficiency of different industries.

The analysis builds on earlier work undertaken by The Allen Consulting Group and the Centre of Policy Studies at Monash University which analysed the potential returns to investments in energy efficiency.<sup>1</sup> As with the earlier work:

- the Monash Centre of Policy Studies' MMRF-Green model was used to assess the economy-wide impacts of achieving specified energy efficiency target levels; and
- the Sustainable Energy Authority of Victoria (SEAV), in conjunction with a number of consultants, developed energy efficiency potential estimates for a range of economic sub-sectors, and provided the input data for the modelling — in particular, the investments in energy saving equipment required to achieve the target and the associated flow of energy savings through time.

The remainder of the paper provides details of the design and operation of a NEET mechanism to improve energy efficiency, the specification of NEET scenarios for modelling, and reports on the results.

---

<sup>1</sup> The Allen Consulting Group 2003, *Economic Impact Analysis of Improved Energy Efficiency*, Report for the Sustainable Energy Authority of Victoria; and  
The Allen Consulting Group 2004, *Economic Impact Analysis of Improved Energy Efficiency – Phase 2 Report*, Report for the Sustainable Energy Authority of Victoria.

## Chapter 2

# Modelling a National Energy Efficiency Target

*The NEET seeks to achieve specified reductions in energy end use in the gas and electricity sectors. The economic and environmental impacts of a range of NEET scenarios were assessed with the MMRF-Green model, utilising input data developed by SEAV on returns to investments in energy efficiency.*

### 2.1 The NEET

The Sustainable Energy Authority of Victoria has identified a National Energy Efficiency Target (NEET) as a potential objective to improve energy efficiency in end use applications.<sup>2</sup>

For the purposes of this analysis, the NEET would be supported by policy to achieve annual reductions in national energy end use.

### 2.2 The MMRF-Green Model

In this report, the economic impacts of a range of NEET scenarios are modelled using the computable general equilibrium (CGE) model MMRF-GREEN run by the Monash Centre of Policy Studies (CoPS). MMRF-GREEN is a multi-sector, dynamic CGE model of the Australian economy covering the six States and two Territories. Since MMRF-GREEN is dynamic, it is able to produce sequences of annual solutions connected by dynamic relationships. The model also includes enhanced capabilities for environmental analysis.

As each State and Territory is modelled as a mini-economy, MMRF-GREEN is ideally suited to determining the impact of jurisdiction-specific economic shocks. It has already been used to address a wide range of issues, including the economic impacts of large export-oriented projects, the effects of global trading in greenhouse emission permits, and the effects of changes in State and Federal tax rates.

More detail on MMRF-GREEN and the modelling exercise in general is provided in Appendix A.

### 2.3 Modelling Inputs

The main inputs to the MMRF-GREEN model for this project were developed from a number of technical projects commissioned separately by SEAV estimating the direct costs and benefits associated with increased energy efficiency, on an industry-by-industry basis.<sup>3</sup> The estimates of energy efficiency improvement

---

<sup>2</sup> Energy end use for the purposes of this report is defined to include all final energy use providing mechanical or thermal energy, but excluding energy used for electricity generation, including cogeneration.

<sup>3</sup> EMET Consultants 2004, *Energy Efficiency Improvements in the Commercial Sub-Sectors*, prepared by EMET Consultants for SEAV, February;  
Energetics 2004, *NFEE: Energy Efficiency Improvement Potential Case Studies – Industrial Sector*, prepared by Energetics for SEAV, March;  
EMET Consultants 2004, *Energy Efficiency Improvement in the Residential Sector*, prepared by EMET Consultants for SEAV, April; and

potential are built from a bottom up, case study based approach (see Appendix B for detail). Lists of *specific energy efficiency measures* ranked in order of increasing simple payback have been prepared for specific sectors. An estimate of the 'business as usual' uptake of energy efficiency was also developed, and subtracted from the 'raw' EEI potential estimate, to derive an estimate of the *net* EEI potential, 'beyond business as usual'.

The energy efficiency potential for each measure was discounted by an applicability factor, before the measure-specific potential was included in the overall (cumulative) results. This factor took account of:

- the extent to which the measure was judged to be already applied in the sub-sector;
- the extent to which the measure was applicable to a certain end-use technology; and
- the normal replacement rate of equipment, where the payback was based on replacement at end of useful life.

This 'bottom-up' approach based on specific case studies makes it possible to estimate the economic EEI potential for a range of commercial assumptions. For the economic modelling included in this paper it was decided to use the energy efficiency improvement potential estimates based on all measures up to and including a 4-year payback. These investments therefore have an internal rate of return exceeding 25 per cent, which is favourable, even for non-core investments by the average firm.

It is assumed that these measures are taken up in a consistent way over the ten year investment period 2005 to 2014, in order to ensure that the annual NEET targets can be met.

The investments in energy efficiency are assumed to have a 12 year life. Therefore, an investment made in year 1 (2005) delivers an annual stream of energy savings through to year 12 (2016). The final tranche of investment made in year 10 (2014) delivers energy savings through to year 21 (2025).

The exogenous inputs (or 'shocks') to the model comprise industry-based projections for the capital cost of additional energy-saving technology, and for the value of energy savings generated by this technology. The estimates represent the potential energy-saving improvements that could be made above and beyond a 'business as usual' baseline — which reflects current AEEI improvements in energy efficiency levels and trends — for paybacks in the range less than or equal to 4 years.

The results from the separate technical studies commissioned by SEAV were integrated into a spreadsheet of capital investments in energy saving equipment and associated energy savings data by SEAV. In the commercial and industrial sectors, a transaction cost of 7.5% was applied to the initial capital cost estimate to derive the overall implementation costs. The spreadsheets were developed so as to be suitable for input to the MMRF-Green model, and then provided to The Allen Consulting Group and CoPS. The macroeconomic modelling results generated by

MMRF–GREEN, presented in the next chapter, are dependent on these separately determined costs and benefits estimates.

## **2.4 Simulation design**

For the MMRF–GREEN simulations, alternative economic 'shock' scenarios are generated that correspond to different NEET energy efficiency scenarios for the industrial, commercial and residential sectors.

The NEET energy savings scenarios are modelled by introducing two exogenous 'shocks' into the MMRF model.

- an increase in investment expenditure on energy savings equipment and services, required to achieve the annual NEET target; and
- a resulting reduction in the amount of primary fuels and electricity required to produce a unit of industrial production or household services, yielding energy input savings equivalent to the annual NEET target.

As a result, in each year, a sufficient investment expenditure shock is applied in the model to achieve annual energy reductions required to meet the NEET target for that year. For example, a one per cent NEET reduces year 5 base-case energy by one per cent of year 4's actual energy use (that is, energy use in year 5 after the year 5 NEET reduction has occurred). The resulting energy savings investment generates energy savings for the following 12 years of the assumed life of the installed energy savings equipment.

It is important to understand that a one per cent NEET does not mean that energy use in the current year has to be one per cent less than energy use in the previous year. The NEET obligation is to achieve end use energy reductions by an amount equal to one per cent of the previous year's energy use. Current year energy use is only relevant for setting the obligation for the following year. The NEET is designed so that it is effectively independent of the level of economic activity in the current year.

For industrial and commercial users, the energy saving is introduced as a shift in the technology of production away from the usage of energy, reducing the input of energy per unit of output. We model the additional capital expenditure on energy-saving measures as a shift in the technology of production towards the use of other manufacturing (producers of more energy efficient machinery and equipment) and construction services (providers of installation services). In other words, for industrial and commercial users, production technologies are assumed to shift away from energy and towards energy-saving products. For capital-intensive industries (such as alumina and aluminium), the energy efficiency potential is assumed to relate to improvements to existing production processes, rather than significant additional capital investments.

For the residential energy user, the energy saving is introduced as a taste change away from the usage of electricity and gas (supplied directly and via the urban gas distribution system). The new expenditure is handled in a similar way as a taste change towards other manufacturing (energy efficient light bulbs, insulation etc) and construction services. In other words, for households we assume a change in their consumption pattern, such that for every one dollar of income spent in each year less is spent on energy and more is spent on energy-saving products.

The resulting MMRF–Green modelling scenarios show the effects of the increased efficiencies and spending, with the economy adjusting away from base case trends to accommodate the changes. The effects of these changes are reported as deviations between the values of variables in the alternative scenarios and their values in the base case scenario.<sup>4</sup>

The NEET was modelled as being applied and acquitted separately in the gas and electricity industries. In reality, it would be possible for energy savings from gas to be (proportionately) less than energy savings from electricity, if the marginal costs of energy savings in electricity are markedly lower than in gas. However, this presents significant modelling challenges, and so was not pursued.

## **2.5 NEET Scenarios**

A number of NEET scenarios were modeled, covering a range of possible combinations of NEET targets and phasing periods.

### ***Targets***

Two targets were modelled:

- a low target of 0.5 per cent 'beyond business as usual' energy savings, ramping up over 3 years and ramping down over 3 years;
- a medium target of 1.0 per cent 'beyond business as usual' energy savings;
  - ramping up over 3 years and down over 3; and
  - ramping up over 5 years and down over 3.

### ***Timeframe of the scheme***

The NEET scheme was modelled as running for 10 years from 2005 to 2014. In the case of the 3 year ramp up period, the scheme achieves full reductions (that is, 0.5 or 1.0 per cent 'beyond business as usual') by 2007.

The model simulations were run out to 2025 (2014 plus 12 years, which represents the effective life of the investments in energy efficiency). Following investments in energy savings from 2005 to 2014, there was no replacement of the capital from 2014 to 2025, so that the energy savings steadily attenuate back to zero as the effective lives of each annual cohort of energy savings end. This allows us to calculate the net present value of the stream of benefits arising *directly* from the investments implemented under scheme, which we can infer as a very conservative estimate of the overall benefits of the scheme.<sup>5</sup>

### ***Specific scenarios***

Three scenarios were modeled using MMRF–Green, with results compared to the base case:

---

<sup>4</sup> In assessing the modelling results from MMRF–GREEN, two fundamental points need to be understood. First, all model results are presented relative to a Base Case. This Base Case represents a 'business-as-usual scenario' as estimated by the model (see Appendix A). Secondly, where a policy shock leads to an estimated decline of GDP of 0.6 per cent, this means that GDP is 0.6 per cent below the level it would have been under the business–as–usual case. It does not mean that the rate of growth is 0.6 per cent lower.

<sup>5</sup> This modelling artefact should not be confused with our understanding of the actual impacts of the scheme — where we would expect the investments to have demonstrated their worth and be replaced on an ongoing basis at the end of their life.

*Scenario 1:* Energy reduction target of 1.0 per cent ramped up over 3 years (see Table 2.1), ramped down over 3 years;

- assesses impact of returns to energy efficiency required to achieve the target;

Table 2.1

**TARGET RAMP UP RATES**

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<i>Scenario 1 - 1.0% Target – fast ramp up / ramp down</i>	0.33%	0.67%	<b>1.00%</b>	<b>1.00%</b>	<b>1.00%</b>	<b>1.00%</b>	<b>1.00%</b>	<b>1.00%</b>	0.67%	0.33%
<i>Scenario 2 - 1.0% Target - slow ramp up/quick ramp down</i>	0.20%	0.40%	0.60%	0.80%	<b>1.00%</b>	<b>1.00%</b>	<b>1.00%</b>	<b>1.00%</b>	0.67%	0.33%
<i>Scenario 3 - 0.5% Target - fast ramp up / ramp down</i>	0.17%	0.33%	<b>0.50%</b>	<b>0.50%</b>	<b>0.50%</b>	<b>0.50%</b>	<b>0.50%</b>	<b>0.50%</b>	0.33%	0.17%

Source: The Allen Consulting Group

*Scenario 2:* Energy reduction target of one per cent ramped up over 5 years, ramped down over 3 years;

- assesses sensitivity to ramp up rate.

*Scenario 3:* Energy reduction target of 0.5 per cent, ramped up over 3 years;

- assesses sensitivity of results to size of target.

## Chapter 3

# Modelling Results

*Results of economic modelling of a NEET indicate that there are significant potential economic and environmental benefits available from investments in energy efficiency.*

### 3.1 Scenario 1: one per cent NEET

Modelling of Scenario 1 gives an indication of the overall economic returns from achieving a one per cent NEET. Overall, around three-quarters of the total energy efficiency opportunities in the SEAV energy efficiency potential database ('100 per cent – low' opportunities with paybacks less than or equal to four years) are implemented in Scenario 1.

The impacts of increased energy efficiency in Scenario 1, plus the net additional spending flowing from the investments in energy efficiency, increase GDP by 0.16 per cent relative to its level in the base case simulation in 2014, equivalent to \$1,573 million in absolute terms (Table 3.1 and Figure 3.1). Consumption, which is an indicator of the overall welfare effects, increases by \$1,028 million in 2014, with a total net present value over the 21 years of the NEET investments of just over \$8 billion (at a discount rate of 4 per cent — NPV<sub>4</sub>).

Table 3.1

#### SUMMARY DATA — 1% NEET

	Absolute deviations at 2014	NPV <sub>4</sub> 2005 — 2023
Real private consumption (\$m)	1,028	8,449
Real investment (\$m)	470	2,023
Real GDP (\$m)	1,573	12,407
Employment ('000 persons)	1.9	-

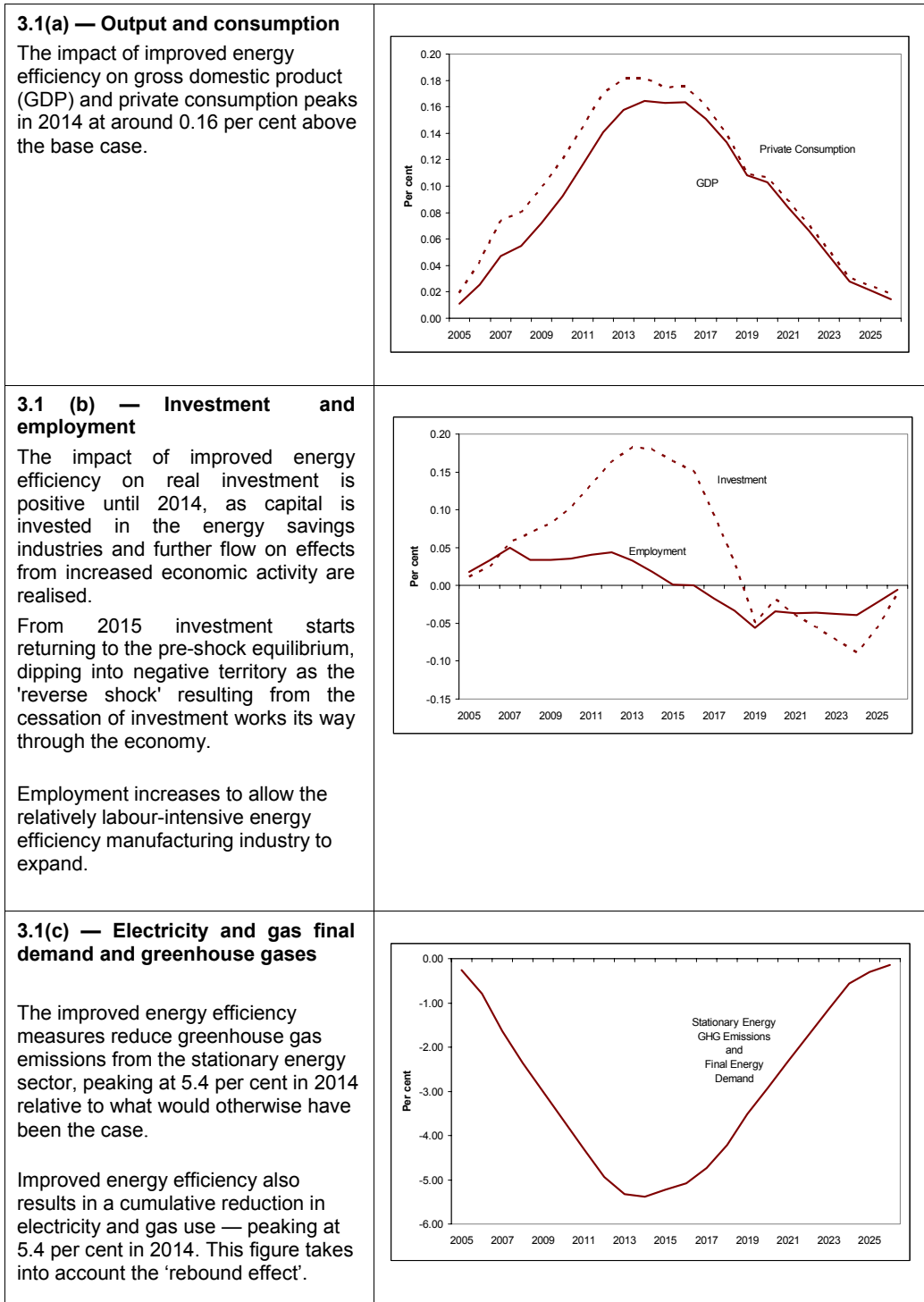
Source: The Allen Consulting Group and Monash CoPS

The year to year effects of the NEET can be broken into three quite distinct phases (Figure 3.1). The first phase covers the years 2005 to 2012. During this period NEET generated spending on energy saving technology occurs and energy savings steadily build up. The second phase, 2013 to 2016, is a period of stability in which little new investment occurs and the energy savings are at a maximum. The third phase, 2017 to 2025 covers the period in which the energy savings steadily decline in the absence of new investment.

In the third phase, the economy returns to long run equilibrium. As the energy savings fall away, so the general climate for investment returns to base case levels. The fall away in labour intensive investment is accompanied by reductions in employment relative to base case levels, to return wages to long run equilibrium.

Figure 3.1

**SCENARIO 1: 1% TARGET; FAST RAMP UP (DEVIATIONS FROM THE BASE CASE)**



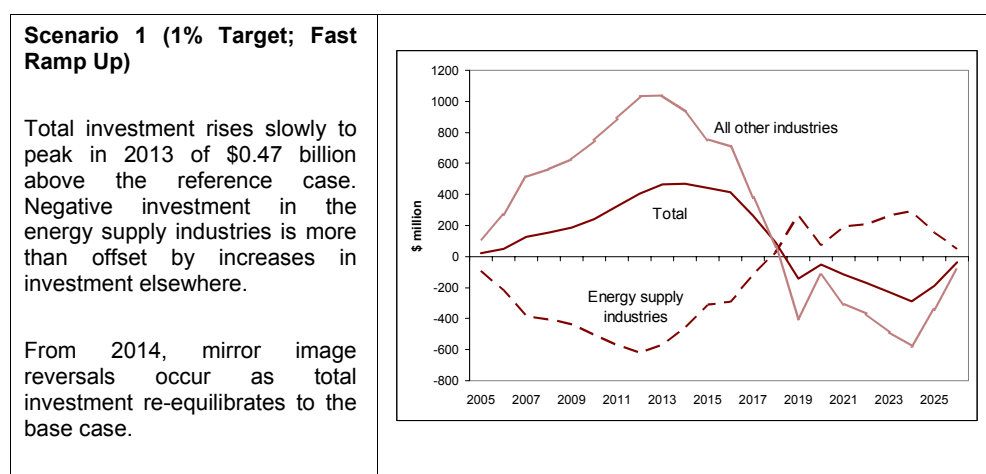
Source: The Allen Consulting Group and Monash COPS

The decline in energy savings in the third phase is somewhat artificial. In reality we would expect that the energy efficiency investments would be replaced at the end of their effective lives (starting in 2017 for 2005 investments), thereby maintaining the energy savings. However, we chose not to model replacement of the investments, to allow us to isolate the direct impacts of the scheme. This approach also ensures we are conservative with respect to technological 'catch up' of the energy efficiency opportunities under business as usual with the opportunities modelled here.

The results of Scenario 1 are comparable to the earlier modelling undertaken by The Allen Consulting Group of the potential for improved energy efficiency.<sup>6</sup> In the earlier modelling, 50 per cent penetration of the less than 4 year paybacks energy efficiency opportunities ('50 per cent – low') contained in the SEAV database resulted in additional real private consumption at 2012 of 0.12 per cent. As noted, achieving the one per cent NEET by 2012 requires penetration of around 75 per cent of the 100 per cent – low measures by 2012 (or equivalently 1.5 times the 50 per cent – low measures), resulting in additional real private consumption at 2012 of 0.18 per cent.

Figure 3.2

**COMPOSITION OF INVESTMENT (DEVIATIONS FROM THE BASE CASE)**



Source: The Allen Consulting Group and Monash COPS

With the reduced demand for electricity and gas resulting from the NEET, investment in the energy supply industries falls. However, this is more than offset by increased investment in other industries, resulting from the investments in energy efficiency equipment and also from expanded economic activity (Figure 3.2).

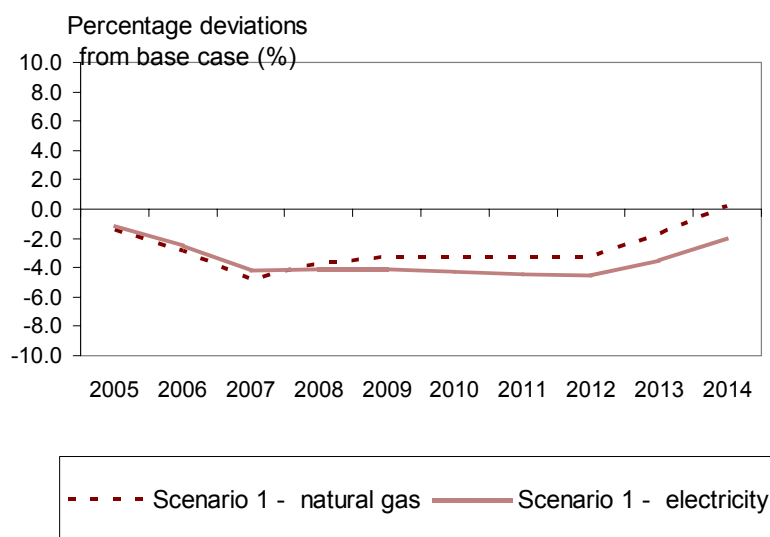
Electricity prices are reduced in Scenarios 1 compared to 'business as usual', due to the declines in electricity demand (Figure 3.3). The reduced growth in demand in

<sup>6</sup> The Allen Consulting Group 2004, *Economic Impact Analysis of Improved Energy Efficiency – Phase 2 Report*, Report for the Sustainable Energy Authority of Victoria. The Phase 2 modelling used the same input data as this report, except that this report only addresses energy efficiency improvement potential and use of gas and electricity.

Scenario 1 reduces (average retail) electricity prices by more than 4 per cent in the period 2008 to 2012 compared to 'business as usual'. In the case of gas, the reduced demand for gas leads to price declines of more than 3 per cent in 2008 to 2012 (Figure 3.3).

Figure 3.3

**IMPACT ON ENERGY PRICES**



Source: The Allen Consulting Group

**3.2 Scenario 2: one per cent target for Australia; slower ramp up rate**

Slowing the ramp up rate for the introduction of the NEET, from 3 to 5 years, has a small but significant impact on overall outcomes for the NEET (Figure 3.4). Comparison of Table 3.3 with Table 3.1 suggests that GDP reduces by around 10 per cent, both in terms of its 2014 peak and on the NPV<sub>4</sub> measure.

Table 3.3

**SUMMARY DATA — 1% NEET WITH SLOWER RAMP UP RATE**

	Absolute deviations at 2014	NPV <sub>4</sub> 2005 — 2023
Real private consumption (\$m)	939	7,555
Real investment (\$m)	464	2,009
Real GDP (\$m)	1,435	11,164
Employment ('000 persons)	2.1	-

Source: The Allen Consulting Group and Monash CoPS

Other macro variables also experience similar impacts, with energy and greenhouse emissions reductions also smaller by around 10 per cent at 2014.

### 3.3 Scenario 3: 0.5 per cent target for Australia; fast ramp up rate

Halving the target roughly halves the impacts of the NEET, suggesting that the results are approximately linear to the size of the target (Figure 3.5). Comparison of Table 3.4 with Table 3.1 indicates that halving the target results in outcomes in Scenario 4 of between 47 and 50 per cent of Scenario 1 outcomes – almost exactly linear.

Table 3.4

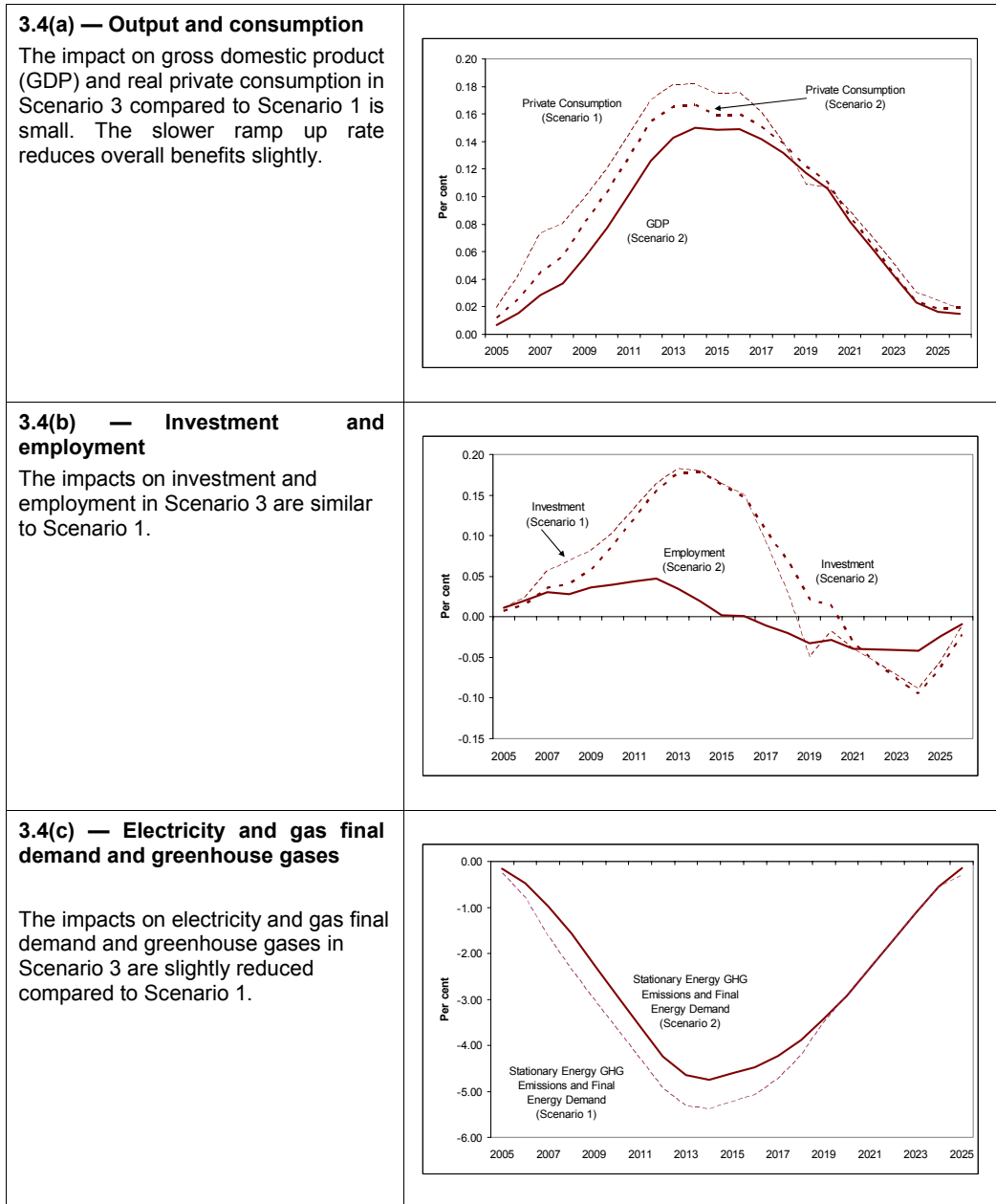
#### SUMMARY DATA — 0.5% NEET

	Absolute deviations at 2014	NPV <sub>t</sub> 2005 — 2023
Real private consumption (\$m)	501	4,091
Real investment (\$m)	237	1,020
Real GDP (\$m)	767	6,025
Employment ('000 persons)	0.9	-

Source: The Allen Consulting Group and Monash CoPS

Figure 3.4

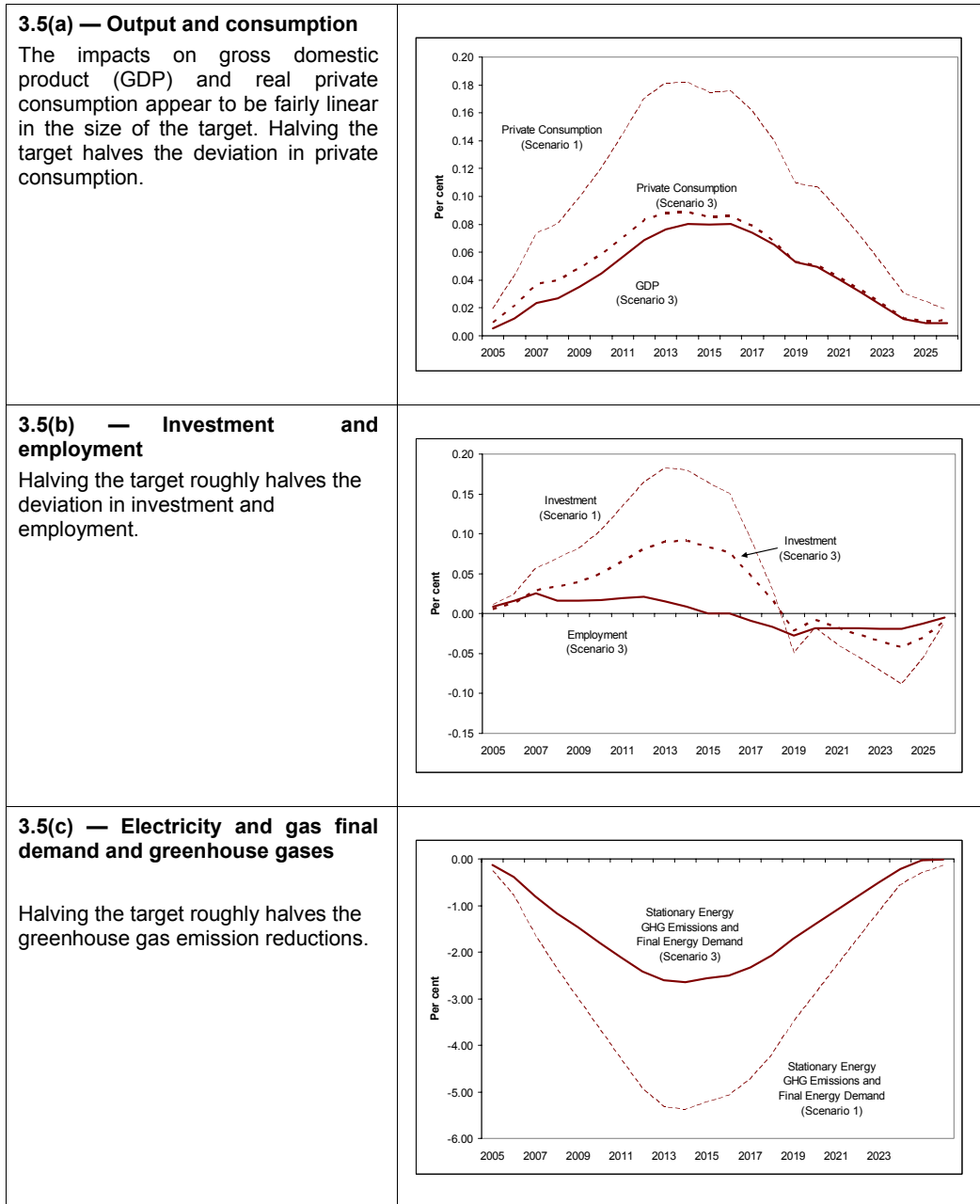
**SCENARIO 2: 1% TARGET; SLOWER RAMP UP RATE (DEVIATIONS FROM THE BASE CASE)**



Source: The Allen Consulting Group and Monash COPS

Figure 3.5

**SCENARIO 3: 0.5% TARGET; QUICK RAMP UP (DEVIATIONS FROM THE BASE CASE)**



Source: The Allen Consulting Group and Monash COPS

## Chapter 4

# Conclusions

*The modelling results contained in this report are consistent with the early National Framework for Energy Efficiency modelling in demonstrating strong economic and environmental returns to investments in energy efficiency.*

### 4.1 Key findings

There is a range of national benefits — economic, social and environmental — to be gained from improving energy efficiency throughout the economy. Consistent with earlier analysis, the modelling of the economic impacts of improved energy efficiency in this report again demonstrates the potential gains that are available in economic growth, consumer welfare and employment, and the significant potential for cost effective reductions in greenhouse gas emissions and energy usage.

Achieving annual energy savings of one per cent beyond 'business as usual' (a one per cent NEET) would deliver an increase in consumption of approximately 0.18 per cent by 2014 (\$1.0 billion), while saving 16.5 Mt CO<sub>2</sub>e of greenhouse gases and reducing electricity prices to end users. The total net present value of increased consumption over the life of the investments initiated by a one per cent NEET is \$8.4 billion dollars.

The results are reasonably linear to the amount of energy efficiency adopted, provided that the investments have paybacks of less than or equal to four years.

## *Appendix A*

# Modelling Methodology

The objective of the MMRF-Green modelling was to assess the economy-wide impacts of take-up of assessed opportunities for enhanced energy efficiency across the residential, commercial and industrial sectors under the NEET. As a first step, the Sustainable Energy Authority of Victoria (SEAV) commissioned separate technical projects to estimate the likely capital costs and energy savings associated with increased energy efficiency on an industry-by-industry and residential basis. The outputs from this technical project were provided to The Allen Consulting Group and constituted the main feedstock for the MMRF-GREEN model, the computable general equilibrium (CGE) model operated by CoPS at Monash University, used here to estimate the economy-wide impacts of increased energy efficiency.

MMRF-Green is a multi-sector dynamic model of the Australian economy covering the six states and two territories. It models each region as an economy in its own right, with region-specific prices, region-specific consumers, region-specific industries, and so on. Since MMRF-Green is dynamic, it is able to produce sequences of annual solutions connected by dynamic relationships. The model also includes enhanced capabilities for environmental analysis.

As each state and territory is modelled as a mini-economy, MMRF-Green is ideally suited to determining the impact of region-specific economic shocks. It already has been used to address a wide range of issues, including the economic impacts of large export-oriented projects, the effects of global trading in greenhouse emission permits, and the effects of changes in state and federal tax rates.

### **A.1 Base case**

The base case for the modelling was the most recent MMRF-Green base case projection for the Australian and state economies, compiled on the assumption that a range of policies are in place and that the efficiency with which energy is used improves at historically normal rates (for example, 0.5% per annum for AEEI — see Box A.1).

## Box A.1

**MMRF-GREEN BASE CASE MODELLING SCENARIO**

The MMRF-Green Base Case is a projection for the Australian and state economies, compiled on the assumption that existing energy policies are in place and that the efficiency with which energy is used by industrial, commercial and residential customers improves at historically normal rates. In this case, these rates of 'autonomous energy efficiency improvement' (that is, average annual rates of change) are 0.6 per cent for energy technical efficiency improvement and 0.5 per cent supply efficiency improvement.

The existing energy policies included in the Base Case modelling scenario are:

- Queensland cleaner energy strategy — this is modelled as autonomous annual shifts towards gas-fired electricity generation and away from coal-fired generation in Queensland sufficient to increase the share of gas-fired generation in total generation in Queensland to 13.1 per cent by 2010 and to keep it at that level through to 2012;
- generator efficiency standards (GES) — we assume that efforts in updating generators will result in a reduction (relative to baseline (no measures) levels) in 2010 of 2 Mt of emissions from black coal generation, of 2 Mt from brown coal generation, and of 1 Mt from gas generation. These reductions are achieved by cost-neutral increases (relative to baseline (no measures) levels) in the annual-rate of fuel-saving technological progress in fossil-fuel generation. For the period 2010 to 2012, we assume that the increases in the annual-rate of fuel saving technological progress deduced for the period 1999 to 2010 continue;
- mandatory renewable energy targets (MRET) and extension to greenpower — the MRET target obliges wholesale purchasers of electricity to proportionately contribute towards the generation of an additional 9.500 GWh of renewable energy per year by 2010. This translates to an additional 34.2 PJ of generated electricity. We implement the scheme via autonomous annual shifts towards renewable electricity generation and away from fossil-fuel generation, sufficient to hit the renewable target in 2010. These shifts are quantity neutral — one PJ increase in renewable generation is matched by one PJ decrease in fossil generation. However, they are not cost neutral since renewables are assumed to be a more costly form of generation. For the years 2010 to 2012, we assume that the renewable share in total generation is maintained at its level achieved in 2010 with the MRET in place;
- greenhouse gas abatement program (GGAP) and greenhouse friendly certification program — this program provides support to activities that are likely to result in substantial emission reductions or substantial sink enhancement up to 2012. We assume that the GGAP will lead to reductions (relative to baseline (no measures) levels) in emissions from the stationary energy sector in each state as listed in the GGAP spreadsheet provided by AGO; and
- NSW electricity retailer benchmark scheme — under the benchmarks, NSW electricity retailers are required to reduce per capita CO<sub>2</sub>-e emissions to 7.27 tonnes by 2007. The scheme allows electricity retailers to comply with their benchmark obligations by: reducing the greenhouse intensity of electricity purchased from generators; improving the energy efficiency of their customers through the promotion of demand management; and offsetting emissions through the purchase of forest sequestration credits. We implement the scheme via a combination of autonomous annual shifts towards gas-fired and renewable electricity generation and away from coal generation, combined with allowance for increased demand management and increased forestry sequestration. The shifts in generator mix are quantity neutral — one PJ increase in gas and renewable generation is matched by one PJ decrease in coal generation. However, the shifts are not cost neutral since gas-fired power and renewable generation are more costly forms of generation. The additional demand management and sequestration occurs in line with mechanisms that relate these forms of abatement to the cost of abatement.

We report the effects of the expansions embodied in alternative policy scenarios as deviations between the values of variables in those scenarios and their values in the Base Case scenario.

Source: CoPS 2003.

**A.2 Other assumptions*****Labour markets***

At the national level, the deviation in the national real wage rate from its base case level is assumed to increase in proportion to the deviation in economy-wide employment from its base case level. Eventually, the real wage adjustment eliminates the deviation in national employment. At the regional level, labour is assumed to be mobile between state economies. Labour is assumed to move between regions so as to maintain inter-state wage and unemployment rate differentials at their base case levels. Accordingly, regions that are favourably

affected by the shocks will experience increased employment and population at the expense of other regions, even in the long run when any deviation in national employment has been eliminated via real wage adjustment.

### ***Public expenditure, taxes and government budget balances***

We assume that the shocks make no difference to the paths of federal and state real public consumption expenditures. We also assume no deviation in the paths of tax rates applying to commodity sales and applying to labour and capital income. Government budget balances are therefore allowed to vary.

### ***Consumption, investment, ownership of capital and measurement of welfare***

In each year of the alternative scenarios, aggregate real consumption in state  $r$  diverges from its base case level by an amount reflecting the divergence in real income available to the residents of  $r$ .

### ***Rates of return on capital***

In deviation simulations MMRF-Green allows for short-run divergences in rates of return on industry capital stocks from their levels in the base case forecasts. Such divergences cause divergences in investment and capital stocks. The divergences in capital stocks gradually erode the divergences in rates of return.

### ***Production technologies***

MMRF-Green contains many types of technical change variables. In the deviation simulations we assume that all technology variables have the same values as in the base case simulation, except for those that are used to implement the alternative scenarios.

### ***Long-run adjustment***

As noted above, MMRF-Green allows for short-run divergences in rates of return on industry capital and in aggregate national employment. Over time, the short-run divergences in rates of return are eliminated via capital adjustment, while short-run divergences in national employment are eliminated via changes in the national real-wage rate. Thus in the long-run (a period of time around ten years after the year of the final exogenous shock), national employment and industry rates of return have returned to their base case levels.

For this paper it is assumed each annual investment has a life of twelve years. Our modelling covers the investment phase and the eleven subsequent years over which aggregate energy-savings gradually fall to zero. In the final year of the simulation, there is no exogenously imposed disturbance to the economy: no additional investment and no additional energy saving. However, this does not mean that the economy has returned to its base case path, since the real-wage and capital adjustment processes are still operating to eliminate the impacts of the gradual removal of the energy-savings. Because of this residual adjustment in the final year, Net Present Value calculations based on results for the simulation period may underestimate the true (beneficial) impacts of the investment in energy efficiency.

## Appendix B

# Inputs for the economic modelling

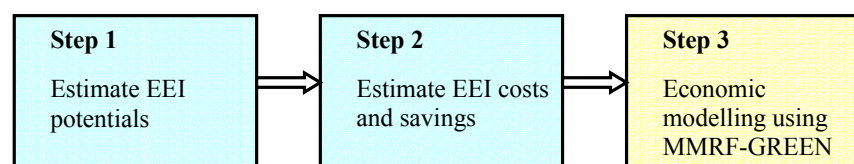
This Appendix is a summary by the Sustainable Energy Authority of Victoria (SEAV) of their approach to developing the inputs for the modelling simulations.

### B.1 Economic Modelling for NEET

A three step process was employed to estimate the national costs and benefits of energy efficiency improvement (EEI), to guide the development of the NFEE, as shown in Figure C.1 below. Steps 1 and 2 were undertaken by a project team comprising SEAV and consultants, while Step 3 was undertaken by The Allen Consulting Group in conjunction with the Monash Centre of Policy Studies. This Appendix provides an overview of Steps 1 and 2, which developed the exogenous shock inputs for the economic modelling of the NEET.

Figure C.1

#### THREE STEP PROCESS TO ESTIMATE COSTS AND BENEFITS OF INCREASED EEI



Source: SEAV

#### Step 1: Estimation of EEI potential estimates

For the purpose of this work a distinction was made between three different types of energy efficiency improvement (EEI) potential:

- **Technical potential** - *technically* possible for a specific energy service (for example, water heating).
- **Economic potential** – the technical potential modified by taking into account standard financial considerations. For this work it was generally based on simple paybacks from energy savings, for a number of scenarios. It assumes that as long as the economic criteria are met, the energy efficiency improvements will be implemented (ie does not take into account other barriers).
- **Market potential** - based on the energy efficiency improvements that are likely to be delivered by the market, that is, the business as usual (BAU) level.

The output from Step 1 was *economic* EEI potential estimates, beyond-BAU levels, for a range of sub-sectors within the residential, commercial and industrial *stationary* energy end-use sectors.

Step 1 produced a range of beyond-BAU economic EEI potential estimates for each sub-sector, based on a number of different payback criteria. For the purposes of modelling a NEET, the EEI potential data was segregated so that separate EEI potential estimates for both electricity and gas were developed. The scenario modelled for this report was based on the EEI potential for all measures *up to and including a 4-year simple payback*.

It is important to note that this is not an estimate of what *will* happen, but is an estimate the EEI potential (above business as usual) that *could be achieved* if all of the EEI opportunities are taken up. NEET will seek to capture some of this currently untapped, but economically viable, energy efficiency potential.

More information on the estimation of EEI potentials is provided in Section 2 below.

### **Step 2: Estimation of EEI costs and savings**

In this step, the beyond-BAU economic EEI potential estimates from Step 1 were used to derive the annual savings (in both energy and dollar) terms and costs of implementing increased levels of energy efficiency across the Australian economy. Only electricity and gas, the target fuels for the NEET, were included in this analysis.

Table C.1

#### **AVERAGE SUB-SECTORAL ENERGY PRICES**

<b>Sector /Sub-Sector</b>	<b>Elec. (\$/GJ)</b>	<b>Gas (\$/GJ)</b>
Agriculture	\$25.0	-
Mining	\$13.5	\$4.5
Food, Beverages & Tobacco	\$22.0	\$6.0
Textiles, Clothing & Footwear	\$25.0	\$8.0
Wood and Paper Products	\$16.7	\$6.0
Chemical Products (ex petroleum)	\$18.0	\$3.8
Building products (ex cement)	\$18.0	\$5.0
Cement	\$18.0	\$5.0
Iron and Steel	\$14.0	\$4.0
Alumina and Aluminium	\$8.0	\$5.0
Other Metal Products	\$10.9	\$6.0
Other Manufacturing	\$19.4	\$6.0
Construction Services	\$25.0	\$8.0
Commercial Sector	\$25.5	\$8.5
Residential Sector	\$36.1	\$13.0

Source: SEAV

To develop the input data for the NEET modelling it was assumed that 100% of the EEI measures relating to electricity and gas, with a payback up to and including 4-years, were introduced over the 10-year modelling period 2005 to 2014. The EEI potential was introduced uniformly over the modelling period, that is, 1/10 was introduced in each year so that the full potential had been applied by year 10. This

energy saving data was then used as the basis of the ‘exogenous shock’ input to the economic modelling.<sup>7</sup>

In the *commercial and industrial sectors*, the EEI potential estimates, combined with the energy end-use breakdown<sup>8</sup> and average energy prices (see Table C.1 above), were used to estimate savings (in energy and dollar terms) achieved by implementing the specified level of EEI in each year of the modelling period.

For each sub-sector, the value of the annual energy savings and the average simple payback associated with the specified level of EEI, were then used to estimate implementation costs in each year. Structural change was taken into account, insofar as the energy use in different economic sub-sectors was allowed to grow at differing rates over the modelling period, based on the growth rates used in the MMRF-Green model.

For the *residential sector*, the estimated annual energy savings (in dollar and energy terms) and annual implementation costs – for electricity and gas EEI measures only - were taken directly from the consultants’ reports and used as the basis of the exogenous shock data.

## B.2 Sectoral EEI potential estimates - methodology

### General approach

Following the initial work undertaken to develop the preliminary EEI potential estimates used in the NFEE *Discussion Paper*<sup>9</sup>, more detailed work was commissioned to derive EEI potential estimates for key commercial (EMET Consultants) and industrial (Energetics) sub-sectors. These consultants had access to SEAV in-house energy audit data, as well as a number of international databases not available to the initial study.

The aim of this work was to develop comprehensive EEI potential curves for each sub-sector, based on lists of *specific energy efficiency measures* ranked in order of increasing simple payback. An estimate of the business as usual uptake of energy efficiency was also developed, and subtracted from the ‘raw’ EEI potential estimate, to derive an estimate of the *net* EEI potential above business as usual.

It is important to note that the energy efficiency potential for each measure was discounted by an applicability factor, before the measure-specific potential was included in the overall (cumulative) results. This factor took account of:

- the extent to which the measure was judged to be already applied in the sub-sector;
- the extent to which the measure was applicable to a certain end-used technology (for example, Variable Speed Drives could not be used for all motors); and
- the normal replacement rate of equipment, where the payback was based on replacement at end of useful life.

<sup>7</sup> For the purposes of the modelling, CoPS sampled this data, so that only the EEI potential required to meet the targets were taken up in each year.

<sup>8</sup> ABARE data was used as the basis of estimating the total stationary energy end use, and fuel source breakdown, for each of the sub-sectors in the first year of the modelling 2005.

<sup>9</sup> Armstrong/SEAV, *Preliminary Assessment of Demand-Side Energy Efficiency Improvement Potential and Costs*, SEAV, November 2003.

This ‘bottom-up’ approach based on specific measures makes it possible to estimate the economic EEI potential for a range of different payback scenarios. For the latest economic modelling it was decided to use the EEI potential estimates based on all measures *up to and including a 4-year payback*, as opposed to the *average 4-year payback* used as the basis of the LOW EEI potential estimate presented in the NFEED Discussion Paper (which could include a package of measures with paybacks ranging from 0 up to 10 or more years). This alternative scenario therefore gives a somewhat lower level of energy savings, and subsequently lower implementation costs, than one based on an average 4-year payback.

Table C.2

**COMPARISON OF COVERAGE FOR PRELIMINARY AND REFINED ESTIMATES**

<b>Phase 1 – Preliminary estimates for Discussion Paper</b>	<b>Phase 2 – Refined estimates for new modelling</b>	<b>Case Study Coverage (% of total energy use)</b>
<b>Commercial Sector</b> Offices Wholesale & Retail Accommodation & Restaurants Health & Community Cultural & Recreational Education	<b>Commercial Sector</b> Wholesale & Retail Trade Accommodation & Restaurants Finance & Business Services Govt. Admin., Health & Education Culture & Recreation, Personal Services	<b>100%</b>
<b>Industrial Sector</b> Agriculture Mining Manufacturing - Food, Beverage, Tobacco - Textile, clothing, Footwear - Wood, Paper, Printing - Coal & Chemicals - Non-Metallic Minerals - Metal Products - Iron & Steel - Basic Non-Ferrous Metals - Other Metal Products - Machinery & Equipment - Other Manufacturing Construction	<b>Industrial Sector</b> Mining Manufacturing - Dairy Product Manufacturing - Meat Products - Baking & Milling - Pulp & Paper Manufacturing - Chemicals - Cement Manufacturing - Ceramics - Iron & Steel Manufacturing - Bauxite & Alumina refining - Aluminium Smelting	<b>65%</b>

Source:

For this work, an estimate of the likely transaction costs for implementing the higher level of energy efficiency in each sub-sector was also undertaken, and applied to the implementation costs.

Similar work was commissioned for some key energy services in the residential sector, although the approach taken to developing the estimates was different than for the commercial and industrial sectors (see below). George Wilkenfeld & Associates undertook EEI potential estimates for residential water heating, and EMET Consultants developed EEI potential estimates for a range of other key energy services.<sup>10</sup>

In all sectors, the consultants estimated the all fuels EEI potential – used as the basis of the economy wide economic modelling – and also segmented the data into electricity and gas components.

This new work has adopted a case study approach, and it should be noted that in the industrial sector it was not possible to develop EEI potential estimates for all sub-sectors in the time available. Table C.2 provides a comparison of the coverage of the preliminary and recent EEI potential work.

### **Commercial sector**

EMET Consultant's work for the commercial sector was based on an existing model, which was updated and used to provide estimates for all commercial sub-sectors.<sup>11</sup> The breakdown of commercial sub-sectors used for this work was slightly different than for the preliminary work (Phase 1), to ensure consistency with the commercial categories used in the MMRF-Green model.

While EMET's work was based on the general approach described above, there are two important differences:

- the estimates took into account measures undertaken in existing, refurbished and new buildings;
- the paybacks were based on overall operating cost savings, rather than just the energy savings.

It is interesting to note that the non-energy related operating cost savings (for example, savings on maintenance, etc) account for around one quarter of the overall operating cost savings. If a similar situation exists in the industrial sector, then the overall operating cost savings in the industrial sector would be significantly larger than have currently been estimated (based on energy savings alone).

### **Industrial sector**

Energetics work was based on a range of case studies, as shown in Table C.2.<sup>12</sup> For the key energy intensive sub-sectors – Iron and Steel Manufacturing, Alumina and Aluminium, and Mining – the case studies essentially covered energy use for the whole sub-sectors. For others, the case studies chosen either represented a substantial proportion of overall energy use or, as was the case with diverse sub-sectors such as Food, Beverage and Tobacco, a number of representative case studies were chosen and the results (weighted by energy end use) were combined to obtain an overall estimate for the sub-sector.

---

<sup>10</sup> Building shell + heating and cooling, refrigeration, lighting, cooking, clothes washing and dishwashing.

<sup>11</sup> For a full discussion of this work see: EMET Consultants, *Energy Efficiency Improvement in the Commercial Sub-Sectors*, SEAV, February 2004.

<sup>12</sup> For full details of this work see: Energetics, *NFEE: Energy Efficiency Improvement Potential Case Studies – Industrial Sector*, SEAV, March 2004.

Estimates for sub-sectors not covered by the Energetics case studies – Agriculture, Other Metal Products, Machinery & Equipment and Other Manufacturing – were based on the estimates developed for the other sub-sectors. These sub-sectors account for only a small proportion of the overall energy use in the industrial sector.

### **Residential sector**

Two consultants were engaged to prepare EEI potential estimates for the residential sector – George Wilkenfeld and Associates (GWA) developed estimates for residential water heating, and EMET Consultants developed estimates for the other key residential energy services.<sup>13 14</sup>

The approach taken by both consultants to developing the EEI potential estimates were similar, and differed to the approach taken in the commercial and industrial sectors:

- For each energy service under consideration (water heating, refrigeration, lighting, etc), an estimate of the BAU energy end use over the modelling period was first developed. These BAU projections took into account any minimum energy performance standards (appliances or houses) which will come into effect over the modelling period;
- A range of cost effective energy efficiency improvements were identified for each energy service – for the residential sector, this included measures with simple paybacks up to 6.5 years;
- The cost effective EEI measures were applied to the BAU energy end use projections to develop estimates of annual energy savings and implementation costs for each year.

### **Development of Exogenous Shock data**

For both the industrial and commercial sector, an approach that was essentially the same as described in Step 2 (above) was used, the main differences being:

- The *average* sub-sectoral payback for implementing a package of EEI measures with paybacks *up to and including 4-years* varied across the sub-sectors. For the commercial sector it was typically around an average 1-year payback, while for the industrial sector it was typically in the range 2 to 3 years;
- The separate EEI potentials for electricity and gas in each sub-sector were applied independently to electricity and gas consumption, and then the results were aggregated for each sub-sector;
- For the commercial sub-sectors, the value of both the energy saving and non-energy savings were calculated;
- An average transaction cost of 7.5% was applied to the initial capital cost estimate, to determine the overall implementation costs.<sup>15</sup>

---

<sup>13</sup> George Wilkenfeld & Associates, *NFEE – Energy efficiency improvement potential case studies, residential water heating*, SEAV, February 2004.

<sup>14</sup> MET Consultants, *Energy Efficiency Improvement in the Residential Sector*, SEAV, April 2004.

<sup>15</sup> Our advice from Energetics was that transaction costs typically add 5 to 10%, with 7.5% as a reasonable average.

Table C.3

**SUMMARY OF EEI POTENTIAL ESTIMATES**

Sector / Case Studies	EEIP – 4-year payback	
	Electricity	Gas
<b>Industrial sector</b>		
<b>A. Agriculture – estimated</b>	5.0%	5.0%
<b>B. Mining</b>	8.4%	1.8%
<b>C. Manufacturing</b>	<b>11.4%</b>	<b>6.9%</b>
Food, Beverages & Tobacco – Dairy Products +Meat Products + Milling & Baking	13.8%	11.0%
Textile, Clothing & Footwear - estimated	6.3%	6.3%
Wood and Paper Products - Pulp & Paper Manufacturing	13.5%	9.8%
Chemicals (ex petroleum) - Basic chemicals	12.1%	8.4%
Non-Metallic Minerals – Ceramics + Cement	6.0%	10.3%
Iron & Steel	9.3%	17.2%
Alumina + Aluminium	12.8%	0.0%
Other Metals - estimated	3.0%	3.0%
Machinery & Equipment - estimated	6.3%	6.3%
Other Manufacturing - estimated	6.3%	6.3%
<b>E. Construction – est.</b>	6.3%	6.3%
<b>Industrial sub-total</b>	<b>10.7%</b>	<b>9.1%</b>
<b>Commercial sector</b>		
Wholesale & Retail Trade	14.7%	7.1%
Accommodation, Cafes & Restaurants	6.2%	34.1%
Communication Services	4.4%	23.3%
Finance & Insurance, Property & Business Services	11.1%	11.1%
Govt. Administration, Education, Health & Community Services	9.4%	4.3%
Culture & Recreation, Personal Services	5.3%	39.5%
<b>Commercial sub-total</b>	<b>10.1%</b>	<b>11.0%</b>
<b>Residential sector (elec + gas)</b>		<b>11.9%</b>

Source: SEAV

**B.3 Summary of Results for Refined Estimates**

The EEI potential estimates used as the basis of the NEET modelling are presented in Table C.3. This table shows the estimated EEI potential over the 10-year period 2005 to 2014, expressed as a percentage of the electricity or gas end use in each sub-sector.

The energy efficiency improvement (EEI) potentials estimated in the recent work are still relatively conservative, and therefore the economic benefits larger than

indicated by the economic modelling. Some of the key factors contributing to this conservatism include:

- the EEI potential work covers only the stationary energy end-use in the commercial, industrial and residential sectors, and therefore explicitly excludes transport<sup>16</sup> and generation;
- the bottom up approach tends to be conservative, as major system improvements tend not to be included;
- the estimates do not include all benefits derived from the deferred investment in energy generation and supply infrastructure.<sup>17</sup>

### ***Industrial sector***

In the most recent work:

- co-generation has been explicitly excluded from the analysis;<sup>18</sup>
- industrial sector EEI potential paybacks are based only on the energy savings – a significantly higher potential might be captured if paybacks were based on overall operating costs savings rather than just energy savings;
- the industrial sector analysis is based largely on upgrading existing plant — generally energy efficiency improvements are most cost effective at the time of major plant upgrades or new plant construction.

---

<sup>16</sup> The recent work by Energetics showed that the all-fuels net EEI potential (at 4-year simple payback) was reduced from 5.2% to 3.4% for the Mining sector, when mobile energy use was eliminated from the analysis.

<sup>17</sup> Modelling has been commissioned from MMA to develop estimates of these benefits.

<sup>18</sup> Co-generation is difficult to include in a bottom-up approach, as it effectively changes the energy prices, and therefore paybacks of all other measures.