Greenhouse and Energy Taskforce

A cleaner energy future




Strategies to reduce greenhouse gas emissions from the Western Australian stationary energy sector

A report to the Minister for the Environment and the Minister for Energy

December 2006

The Taskforce

On 30 May 2005, Western Australian Environment and Science Minister Judy Edwards announced a high-level taskforce to help Western Australia 'make a substantial leap forward in its approach to managing greenhouse gas emissions'.

The Greenhouse and Energy Taskforce was asked to provide advice to the Western Australian Government on practical and economically feasible ways to manage greenhouse gas emissions from the stationary energy sector.

The Taskforce was chaired by Dr Roy Green, AO, FTSE. Dr Green has been the Deputy Chair of the Environmental Protection Authority and has undertaken senior roles throughout his career in Australia, such as Chief Executive Officer of the CSIRO, Chairman of the National Land and Water Resources Audit and President of the Murray Darling Basin Commission.

The other four independent members were:

- Mr John Akehurst, CEO of Biostarch Pty Ltd, Director of Alinta and Coogee Resources and the former CEO of Woodside Petroleum Ltd;
- Mr Richard Begley, Director of Insight Economics and a specialist in greenhouse and sustainable energy economics;
- Dr John Zillman, AO, FAA, FTSE; former President of the World Meteorological Organization, former Director of the Australian Bureau of Meteorology and a former Principal Delegate of Australia to the Intergovernmental Panel on Climate Change; and
- Ms Cathy Zoi, Group Executive Director of Bayard Group and the former chief of staff of environmental policy in the Clinton White House.

Clockwise from left back: Dr Roy Green, Ms Cathy Zoi, Mr John Akehurst, Dr John Zillman and Mr Richard Begley.

Ex-officio government members and the complete Terms of Reference are listed at Appendix 1.

Foreword

In the 15 months that the Greenhouse and Energy Taskforce has been active, the profile of climate change has grown significantly. There is an ever-increasing urgency pertaining to the issue, with many reports and studies appearing and stronger policies put in place. The recent comprehensive Stern Review emphasises that there are both challenges and opportunities in transiting to a low-carbon economy, but that there are likely to be very high prices attached to delays in taking action.

Here in Western Australia (WA), the Government has already taken a number of initiatives, of which the most significant is the Greenhouse Strategy, released in 2004. It also established this Taskforce, to provide advice on management of greenhouse gas emissions in the stationary energy sector, and related issues such as emissions trading and offsets.

The Greenhouse and Energy Taskforce adopted a pragmatic approach. It has recognised the nature of WA's economy, with its strong dependence on natural resources and its exposure to international competition. Hence we suggest a strategy to move with and adapt readily to national and international policies on climate change, while at the same time promoting proactive measures to reduce emissions from stationary energy sources without unduly impacting on the State's economic and social wellbeing.

The principal 'no regrets' opportunity is in energy efficiency. The International Energy Agency in its report 'Energy Technology Perspectives' notes that improvement in energy efficiency 'is often the cheapest, fastest and most environmentally friendly way to reduce emissions'. The Taskforce believes there are significant opportunities for emission reductions through efficiency improvements, and has made recommendations which should help to achieve substantial outcomes in this area.

The Taskforce is strongly of the view that the long-term costs and impacts of greenhouse gas emissions need to be factored into the decision process. It considers this will require a market-based carbon price signal, and therefore encourages the State to continue its efforts to achieve a national emissions trading scheme, fair to all participants, as a precursor to global emission trading arrangements.

Timing for any such national scheme is uncertain, and the Taskforce has proposed offsets arrangements that could be used in WA for the transitional period to enable government-imposed emission caps to be achieved. The most valuable contribution of the Offsets Working Group to this issue is gratefully acknowledged.

The Taskforce also considers that investment in renewable energy resources needs to be encouraged, through government arrangements to facilitate their development and to distribute the costs equitably. Despite the higher costs to achieve given emission reductions in the short-term, there are potential offsetting benefits through industrial development, energy diversity and security that need to be weighed against these additional costs.

While focussing on market-based strategies to achieve the desired outcomes, the Taskforce considers identification of targets, for example for emission reductions, efficiency improvements and renewable energy resources, is valuable. Many governments have adopted this practice; the concept is easily understood, and profiles, achievements and challenges are readily displayed and communicated.

The Taskforce, its staff and its advisers have consulted widely in preparing this report and its recommendations. The assistance and information provided by the ex-officio members were highly appreciated. We were grateful for feedback and suggestions from members of the High Level Stakeholder Group on Greenhouse and the Greenhouse Interdepartmental Committee.

Some of the issues were contentious, and required considerable debate and background research to achieve consensus; the conclusions should be the stronger for that. The intention has been to provide a package of measures that together will achieve management of greenhouse gases at lowest possible cost. The actual costs will, of course, depend on the reduction levels the Government decides are necessary.

The Taskforce commends the WA Government for the initiatives it has already taken, and trusts that the advice it has provided will assist the Government to determine future policy and action.

Dr Roy Green

Chair, Greenhouse and Energy Taskforce

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Executive Summary

In addressing its terms of reference, the Taskforce acknowledges the mounting scientific evidence that human activities are leading to adverse changes in our climate system, and the WA Government's desire to manage greenhouse gas emissions so that serious impacts do not occur. Scientific consensus is that this will require global reductions of the order of 50 to 60% below 1990 levels by 2050. This corresponds with the WA Government's request to advise on the feasibility and implications of such a reduction from stationary energy sources, which account for about half of WA emissions and an even greater proportion of emission growth. To reduce to one half of 1990 levels by 2050 actually means a reduction by a factor of approximately eight from a best estimate of a 'business-as-usual' scenario. This is clearly a very significant challenge.

The Taskforce is also conscious of the nature of WA's economic structure, with a heavy emphasis on trade-exposed export industry, and that the State has only a small absolute level of emissions (albeit high on a per-capita measure). Injudicious unilateral action would achieve little and could impact heavily on the WA economy. The Taskforce believes that global action on greenhouse will strengthen as the consequences of climate change become more evident, but the timing of a global framework is currently uncertain. WA should participate in achieving a global solution, and its policies, planning and preparation should be geared to implementation of proactive measures in line with global developments.

There are, of course, measures that can be implemented forthwith to achieve emission reductions that do not impact seriously on WA industry or the community. The Taskforce is strongly of the view that the sooner such measures are implemented the better, particularly as achieving the longer-term targets is critically dependent on early actions wherever they are viable.

Other measures will involve more significant costs, but will be necessary if WA is to move towards the deeper cuts in emissions which are considered necessary to prevent unacceptable impacts. The Taskforce has assessed a range of measures available, and the likely costs associated with them. The Taskforce has developed an integrated set of recommendations which the WA Government could use in reaching its decisions on policy measures and priority actions for emission abatement in the stationary energy sector, taking into account, as it must, the broader span of objectives across the economy as a whole.

In reaching its conclusions and recommendations, the Taskforce considered it was essential to recognise that greenhouse gas emissions impose a cost on the community that is not currently accounted for in the market. The Taskforce believes that this could start to be recognised through a national emissions trading scheme, and also when evaluating technologies and energy efficiency measures.

Section 6 of the report provides the Taskforce's key findings and recommendations against the terms of reference. In this executive summary, the structure follows that of the report.

Abatement potential

While acknowledging that there are significant risks and uncertainties, the Taskforce believes that the combination of measures set out in this report could return greenhouse gas emissions to current levels by around 2030. This provides a pathway towards deeper emission cuts by 2050. It is clear, however, that meeting a 50% reduction in emissions on 1990 levels by 2050 would require substantial new breakthroughs in energy technology. Widespread deployment of energy efficiency or lower emission technologies is unlikely without either mandatory requirements or a carbon price signal. The Taskforce has made recommendations which it believes would enable these savings to be harvested. It has also recommended that the WA Government enhance its leadership role.

From a policy perspective, WA's low-emission technology effort could focus on improved efficiency in the immediate and short-term and on securing competitive advantages over the longer-term. In partnership with industry and the research community, the State can invest significantly in relevant **research and development** initiatives related to these needs, safe in the knowledge that accelerated technological innovation is an internationally accepted way of tackling climate change, while at the same time positioning for economic opportunity.

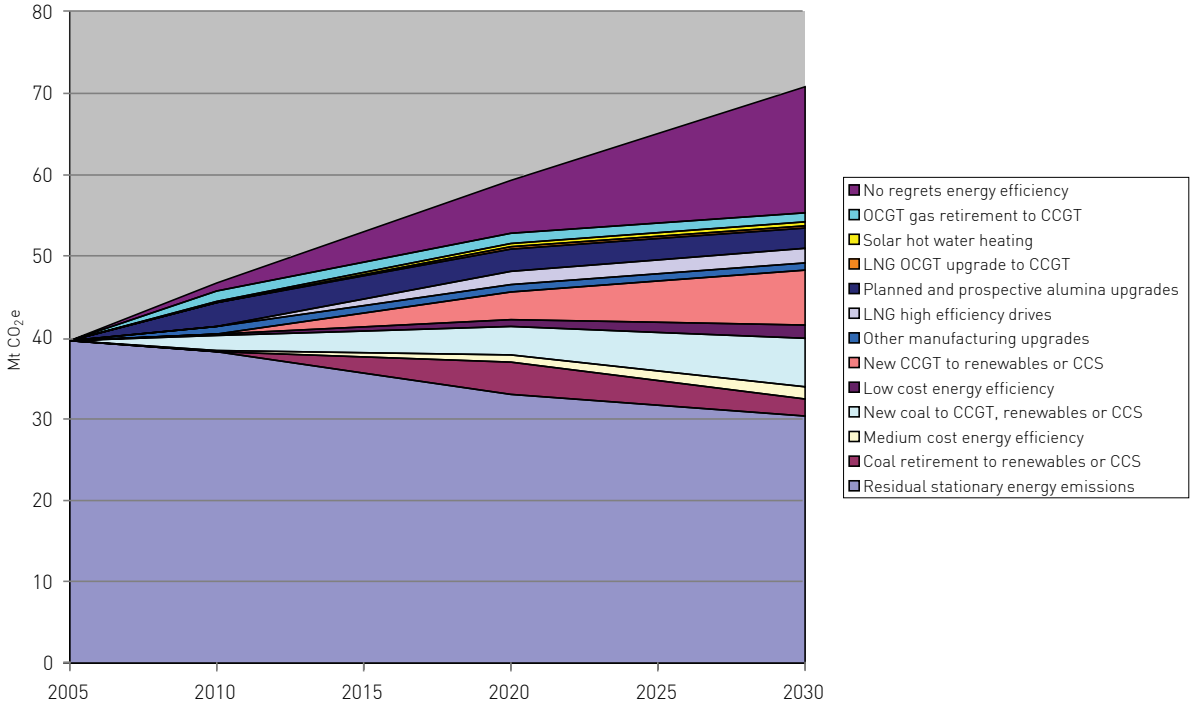
Developing competitive sources of **renewable energy** in Western Australia offers potentially significant returns in a low carbon future, particularly if based on Western Australia's natural advantages. While the costs are high currently, they are on a downward curve. Other factors also need to be considered, such as industrial development opportunities and energy diversity and security.

Of particular importance to the achievement of cleaner energy supply is the need to **capture and store emissions.** Development of the associated technologies is progressing strongly both nationally and internationally. This recognises that, globally, fossil fuels are a major source of energy. WA needs to ensure that it is ready to adopt these technologies as soon as they become viable.

The wedge diagram below indicates the scale of emission reductions which modelling indicates are potentially achievable from energy efficiency and low emission supply options in 2020 and 2030, if a market-based carbon price of $25/t carbon dioxide equivalent (CO_2e) was in place, complemented by other policies and measures:

- Energy efficiency improvements with private internal rates of return exceeding 15% (i.e. meeting or exceeding normal investment guidelines) could reduce energy use by 19 Mt CO_2e by 2030; and
- Low to zero emission supply options provide potential emission reductions of 22 Mt CO_2e by 2030.

As the Taskforce believes that a carbon price of $25/t is likely by 2020, strong actions to implement these two measures could result in stationary energy emissions being lower in 2030 than they were in 2005.



Indicative greenhouse gas abatement 'wedges' from technology and energy efficiency at a carbon price of $25/t CO_2e

The net potential is a reduction by 2030 to about the current level of emissions, if immediate, strong and ongoing commitment is made to the policies and programs identified by the Taskforce. While providing a pathway to deeper cuts by 2050, achieving 50% of 1990 levels would require substantial breakthroughs in energy technology.

Targets and market mechanisms

Although achieving a reduction to 50% below 1990 levels by 2050 does not appear feasible without technological breakthroughs, the Taskforce believes that the WA Government should still establish this as an indicative target. The timeframe is such that new, more efficient technologies and processes are expected to become available. Such a target is also in line with targets adopted by a number of other states and nations.

Of more significance is the need to drive action in the shorter term. Most economic modelling shows that the earlier the action, the lower the cost and the higher the likelihood of achieving the long-term targets. The Taskforce considers this requires a short-term target. It is, however, concerned that a mandatory emissions reduction target, while simple and easy to understand, might prove very costly, particularly if the global response is less rapid than anticipated. It has therefore proposed a market approach to this issue; establishing a price trajectory for the cost of carbon through time, to drive emission reductions but to keep the costs within targeted limits in the medium term. The pricing arrangements would have to be reviewed at regular intervals of three to four years to determine whether the reductions are being achieved, and strengthened if that is not the case.

Emissions trading is a market-based instrument widely regarded as an effective and efficient means to achieve national or global emissions reductions at least cost over the long-term. WA is working with the other states and territories towards the development of a National Emissions Trading Scheme

(NETS). The Taskforce considers that the broad direction of the NETS proposal is appropriate, with many of the proposed features beneficial from WA's perspective, and strongly supports ongoing endeavour to establish a NETS which it considers to be a key component in achieving greenhouse abatement. Nevertheless, some aspects which could be disadvantageous will require careful attention by the WA Government.

Offset is a term used to describe greenhouse gas removal or reduction by a discrete activity that is then used to counterbalance or 'offset' emissions elsewhere in the economy (such as a power station). Examples of offsets are: planting trees; capturing and storing greenhouse gas emissions; and modifying industrial processes to reduce emissions. The Taskforce has considered the potential for offsets to be used as one way by which proponents can meet emission restrictions, providing the flexibility to take the lowest cost approach to achieve an emissions cap. It has set down the requirements which it considers to be necessary for a WA offset regime.

Economic analyses

Several recent studies have concluded that:

- the global cost of taking action is less than the cost of not taking action; and
- the cost of substantial greenhouse gas abatement will be lower if prompt action is taken.

Macroeconomic modelling of the proposed NETS indicated that a carbon price in the region of $25/t CO_2e would reduce emissions substantially with minimal overall economic impact. At higher prices, the economic impacts of achieving abatement rise quite sharply.

Unilateral greenhouse gas abatement actions by WA could lead to net economic cost, but may still be justified on complementary policy, preparedness and new industry development arguments. Care would be needed in the design of any package of unilateral actions to ensure costs are identified and kept to acceptable levels.

Recommendations

Recommendation 1 The Taskforce recommends that the WA Government set policy goals for action to reduce greenhouse gas emissions as follows:

i. To maximise the chances of success of international efforts to prevent dangerous and costly climate change;

ii. To reduce emissions in ways that avoid severe or seriously inequitable economic impacts on WA industry or the community and avoid stranded assets;

iii. To limit the expense to WA taxpayers to that which is reasonable, cost effective and equitable in the context of global initiatives; and

iv. To review progress regularly and incorporate additional measures as they become appropriate in the national and global context.

Recommendation 2 The Taskforce recommends that the WA Government strengthen government capacity and expertise in greenhouse policy development commensurate with the increasing priority of the issue.

Recommendation 3 The Taskforce recommends that, to harness cost effective efficiency opportunities and reduce energy waste, the WA Government:

i. Improve pricing signals in energy markets through carbon pricing, mandatory use of smart metering, tests for network augmentation, and allowing network service providers to recover foregone revenue from demand side investments;

ii. Support and extend energy rating and labelling;

iii. Implement world class minimum energy performance standards for appliances, homes, office buildings and industrial equipment, extend their coverage, factor in a carbon price and regularly review standards to keep pace with technology development;

iv. Establish a mandatory energy efficiency program for large to medium energy users, initially to ensure that efficiency opportunities that offer no regrets greenhouse savings to the community as a whole are implemented; and

v. Establish an Energy Savings Fund, based on the NSW model of a small surcharge on energy consumption, to identify and invest in energy savings, home energy retrofitting, awareness raising, incentives, rebates and energy auditing for small and medium enterprises.

Recommendation 4 The Taskforce recommends that in order to discourage new investment in high emission technologies, the WA Government undertake the following steps:

i. Make a clear statement of policy intent that WA will need to move towards a less carbon-intensive economy;

ii. Require significant new generators to minimise emissions in line with contemporary emission intensity benchmarks, taking steps to limit any adverse impact of resulting electricity price rises;

iii. Require all high CO_2 content natural gas fields to use capture and storage technology for fugitive emissions; and

iv. Facilitate adequate and economic gas supply through a domestic gas reservation policy and the development of adequate pipeline capacity.

Recommendation 5 The Taskforce recommends that, in order to prepare WA for future carbon pricing, the WA Government:

i. Make a clear statement that, as a general principle, all new stationary energy developments will be liable for the full cost of future greenhouse gas emission compliance; and

ii. Foreshadow a future carbon price, develop a carbon risk analysis framework and consider imposing a requirement for project proponents to undertake a carbon price sensitivity analysis.

Recommendation 6 The Taskforce recommends that, in order to facilitate longer term technology development, the WA Government:

i. Establish a dedicated and technically competent Greenhouse Technologies Development Unit to plan, coordinate and implement an Energy Technology Innovation Strategy;

ii. Assign the Greenhouse Technologies Development Unit, as a first task, to scope and plan the science infrastructure needs, including human resources, relevant to the development of world class research activity in emission reduction technologies in partnership with industry and academe;

iii. Establish a low emission technology development fund, to leverage significant Commonwealth and other public and private research and development expenditure to position WA industry to prosper in this field of economic opportunity, and to support research and development identified as high priority for WA.

iv. Provide incentives to attract cutting edge projects and develop skills, critical mass and intellectual property in emerging low emission technologies which have particular relevance to the State's needs and competitive advantage;

v. Work with industry to undertake a detailed feasibility study for carbon capture networks in industrial regions;

vi. Undertake a detailed identification and assessment of potential sites for geo-sequestration of CO_2, geothermal, wind, wave and tidal energy development and review any barriers to deployment of these technologies;

vii. Establish policy measures to secure strategic geo-sequestration sites; and

viii. Encourage proponents of new energy intensive projects to provide financial contributions to the low emission technology development fund.

Recommendation 7 The Taskforce recommends that the WA Government take significant additional steps to promote the development and expansion of renewable and very low emission energy, including:

i. Setting a mandatory renewable energy target for the South West Interconnected System (SWIS) through to 2020 of the order of 15 to 20%, recognising the desirability of keeping costs consistent with the carbon price trajectory set out in Recommendation 11;

ii. Measures to provide further support for renewable and very low emission energy technologies, including geothermal, solar and wave technologies, which have significant potential for WA in the future, but that are not yet sufficiently developed to compete with established technologies (such as wind). Consideration should be given to:

- sub targets for particular technologies set within the overall target;
- premium tariffs or subsidies per unit of energy supplied; and
- capital grants or concessional finance;

iii. Implementing a project facilitation service to assist projects to access finance, locate suitable sites and deal with planning, approval and grid connection processes and barriers; and

iv. Calling for expressions of interest to establish a pilot geothermal (hot dry rock) energy project in WA.

Recommendation 8 To strategically prepare for a carbon constrained world, the Taskforce recommends that the WA Government:

i. Fast-track work to identify suitable geo-sequestration sites in WA;

ii. Facilitate a pilot geo-sequestration project in the Perth Basin; and

iii. Require all major new fossil fuel plants to plan for future carbon capture retrofit as carbon capture and storage (CCS) technology becomes available.

Recommendation 9 The Taskforce recommends that the WA Government lead by example by:

i. Buying or leasing, and operating, minimum 5-star buildings or tenancies (subject to availability), buying the most efficient appliances in range, and ensuring all computer and office equipment is Energy Star compliant and enabled;

ii. Purchasing a greater proportion of Green Power for government electricity use, establishing new energy efficiency targets for government agencies and extending its Carbon Neutral and Solar Schools programs;

iii. Establishing a program to progressively install cogeneration in government-owned hospitals and other appropriate institutions wherever possible; and

iv. Continue working closely with and assisting local government in their greenhouse gas abatement initiatives and programs.

Recommendation 10 The Taskforce recommends that the WA Government adopt an indicative target to reduce greenhouse gas emissions to a level of 50% below 1990 levels by 2050.

Recommendation 11 The Taskforce recommends that, to provide direction for policy development and private investment in the short-term, the WA Government:

i. Develop an estimate of the future risk weighted carbon price trajectory;

ii. Base policy for achieving substantial emissions abatement by 2020 on this estimated carbon price trajectory;

iii. Determine indicative emission reduction profiles based on the carbon price trajectory; and

iv. Establish legislative triggers for progressive policy intervention every three to four years to strengthen policies if current measures fail to deliver the desired emission reductions toward the 2020 and 2050 objectives.

Recommendation 12 The Taskforce recommends that, in order to prepare WA for future carbon pricing, the WA Government:

i. Endorse national emissions trading as a preferred domestic transition to a carbon constrained world;

ii. Continue to work with the National Emissions Trading Taskforce towards a national scheme involving the Commonwealth and the States and Territories;

iii. Support implementation of the National Emissions Trading Scheme based on:

- a phased approach to sectoral coverage commencing with the electricity generation sector;
- assistance for adversely affected firms through the allocation of permits;
- assistance for trade-exposed energy intensive industry to account for the impacts of the scheme on individual projects; and
- inclusion of offsets.

Recommendation 13 The Taskforce recommends that, in establishing a WA offset regime, the WA Government:

i. Promote the establishment of a national registry to govern offset creation, registration and trade and provide a set of common offset rules for all national programs;

ii. Seek compatibility with international rules for offsets;

iii. Establish a WA registry:

- to manage WA offsets as an interim measure before a national registry is in place; and
- to manage WA offsets that meet international requirements but are not recognised nationally;

iv. Establish a regulatory body to determine the parameters and establish procedures to ensure that offset standards are applied and that there is no double counting; and

v. Assess the WA potential for offset supply and facilitate their supply through government programs.

Recommendation 14 The Taskforce recommends that the WA Government:

i. Strengthen its capacity for greenhouse policy related economic analysis, including consideration of a specialist area and additional on-going resources;

ii. Initiate additional economic analysis on the following initial priorities:

- the existing extent of subsidies that encourage higher emissions and the opportunities to eliminate or reduce perverse subsidies;
- analysis of the likely costs and benefits of key emerging technologies including, for example, CCS, geothermal and wave;
- underpinning modelling and data for drawing the proposed carbon price trajectory; and
- economic impacts on WA of market measures, particularly emission trading scheme design options.

Dr Roy Green | Mr John Akehurst | Mr Richard Begley | Dr John Zillman | Ms Cathy Zoi

Acronyms

ABARE	Australian Bureau for Agricultural Research and Economics
AGO	Australian Greenhouse Office
AP6	Asia Pacific Partnership on Clean Development and Climate
CCP Plus	Cities for Climate Protection Plus Initiative
CCPP	Cities for Climate Protection Program
CCGT	Combined Cycle Gas Turbine
CDM	Clean Development Mechanism
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CCS	carbon capture and storage
COAG	Council of Australian Governments
CSP	concentrating solar power
EU	European Union
FCCC	Framework Convention on Climate Change (United Nations)
GSP	Gross State Product
IEA	International Energy Agency
IMO	Independent Market Operator
IPCC	Intergovernmental Panel on Climate Change
ITC	Induced Technical Change
JI	Joint Implementation
LETDF	Low Energy Technology Development Fund
LNG	Liquefied Natural Gas
MEPS	Minimum Energy Performance Standards
MRET	Mandatory Renewable Energy Target
NETS	National Emissions Trading Scheme
NETT	National Emissions Trading Taskforce
NGGI	National Greenhouse Gas Inventory
ppmv	parts per million by volume
PV	photovoltaic
RECs	Renewable Energy Certificates
RRPGR	Remote Renewable Power Generation Program
SEDO	Sustainable Energy Development Office
SWIS	South West Interconnected System
VRET	Victorian Renewable Energy Target

1 The Challenge

1.1 Introduction

There is mounting scientific evidence that human activities are leading to adverse changes to global and regional climate as a result of the emission of carbon dioxide and other greenhouse gases from the burning of fossil fuels and other sources.

Nations have responded to this emerging threat to the long-term sustainability of water resources, health, food supply, industry development and environmental quality by negotiating the 1992 United Nations Framework Convention on Climate Change (FCCC) with the ultimate objective of stabilising greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human) interference with the climate system.

There is an emerging international consensus that, if we are to avert serious adverse changes of climate by the end of the century, we must reduce global greenhouse emissions to well below their 1990 levels by 2050. Most countries are now considering their role in meeting this critically important global challenge. The Western Australian Government has sought advice on policies and measures to enable it to play its part in the global effort and on the feasibility and implications of reducing greenhouse gas emissions from the WA stationary energy sector by 50% of the 1990 level by 2050.

Figure 1.1 illustrates the nature and magnitude of the challenge in terms of : 1) historical emissions from the WA stationary energy sector; 2) the current best estimate of 'business-as-usual' projections of carbon dioxide emissions to 2050 and 3) a schematic depiction of the trajectory of emissions needed to achieve a 50% reduction of 1990 levels by 2050.

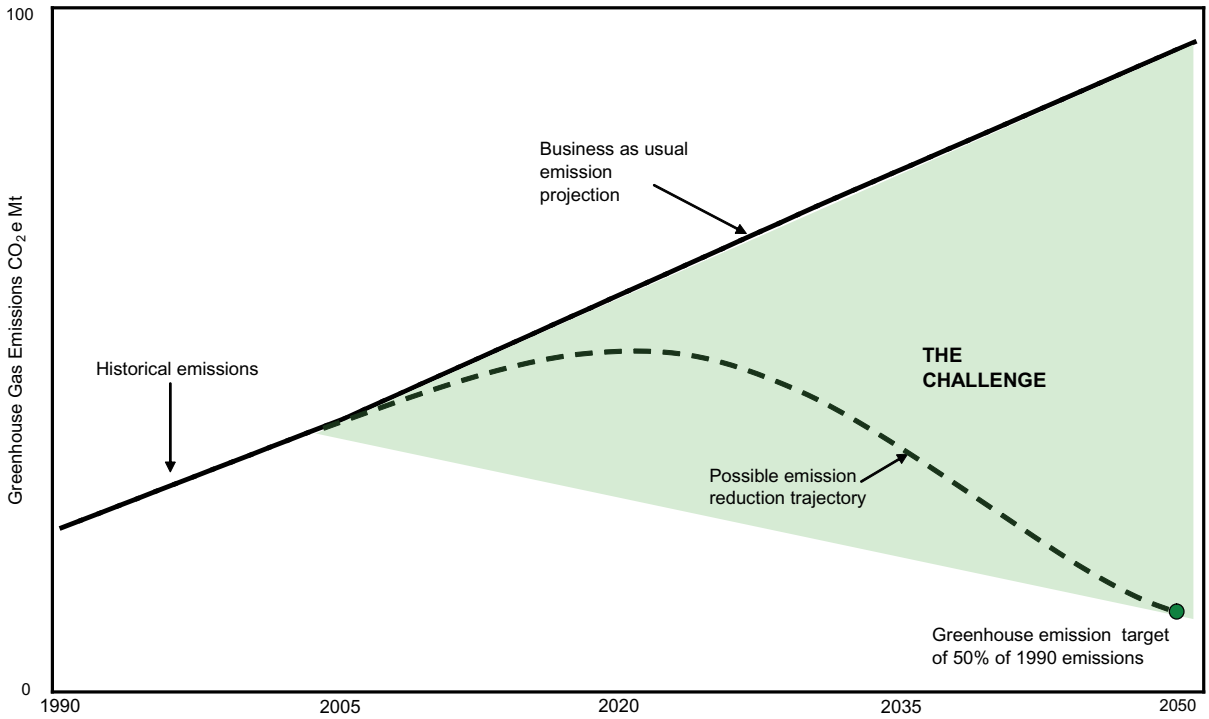


Figure 1.1 Schematic representation of historical and projected Western Australian stationary energy (SE) greenhouse gas emissions and the challenge to achieve 50% of 1990 levels by 2050

1.2 Background on climate change

There is strong scientific evidence for climate change[1].

Global mean temperatures are increasing and this is almost certainly due in large part to human activities

After more than three decades of observation, research and analysis, there is clear evidence that global mean temperatures are increasing and that the observed global warming is largely due to the enhancement of the Earth's natural greenhouse effect[2] through the build-up of carbon dioxide and other greenhouse gases resulting from human activities.

The Taskforce has accepted the Intergovernmental Panel on Climate Change's evidence of climate change as providing the scientific basis for action.

There is mounting observational evidence[3] for climate change and its impacts, including that:

- global temperatures have risen 0.6 to 0.7°C since the start of the 20th century, with sharper rates of increase since 1986 and nine of the ten hottest years occurring in the last decade;
- most mountain glaciers are in retreat and melting at unprecedented rates, the Arctic sea ice is contracting and the Greenland ice sheet is shrinking in area;
- plant and animal distributions are changing as they move with shifts in climate; and
- the frequency of extreme weather events appears to be increasing and leading to record insurance losses.

In WA, average temperatures have risen broadly in line with global trends, with regional changes in rainfall including a 10% decline in the southwest and an increase in the north and inland areas.

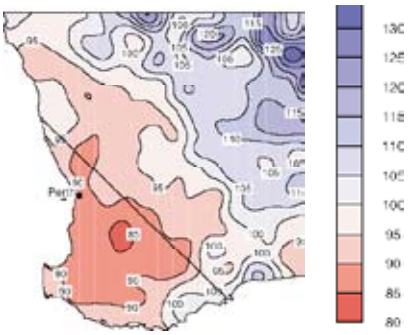


Figure 1.2 Average rainfall in south-western WA 1976-2001 as a percentage of the average over the previous 50 years (IOCI) [4]

The southwest of WA has experienced a substantial decline in rainfall over recent decades

While many of the observed changes of climate cannot be unambiguously attributed to human influence, it is now considered to be almost certain that the rise in global mean temperature is due to increasing concentrations of greenhouse gases in the atmosphere.

[1]In this report the term 'climate change' is used with the meaning defined in Article 1 of the United Nations Framework Convention on Climate Change(http://unfccc.int/essential_background/convention/background/items/2536.php), i.e. 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. This is different from normal scientific usage in the reports of the Intergovernmental Panel on Climate Change (IPCC) (http://www.ipcc.ch/index.html) where the term 'climate change' is used to refer to any change of climate, irrespective of the cause and thus includes both human-induced change and natural variability. It is important, when interpreting scientific statements about climate change, to be clear as to which definition is being used.

[2]See Appendix 2 for a brief elaboration of climate change science and the work of the Intergovernmental Panel on Climate Change (IPCC).

[3]Three summaries of recent science include: Australian Meteorological and Oceanographic Society (AMOS), Statement on Climate Change, Bulletin of AMOS, 19 (2006) pp 93-94; Steffen, W. (2006) Stronger evidence but new challenges: Climate Change Science 2001-2005, Australian Greenhouse Office; WRI Issues Brief (2005) Climate Change Science: Major new discoveries, World Resources Institute.

[4]Indian Ocean Climate Initiative, Climate Variability and Change in South West Western Australia, September 2002, Figure 2, p2.

There is considerable uncertainty associated with the prediction of future climatic conditions: however, computer models are helping scientists to understand historical trends and project likely future climate change for a range of possible greenhouse gas emission scenarios.

According to the 2001 report of the Intergovernmental Panel on Climate Change (IPCC)[5] , models are projecting global mean warming over the next century ranging between 1.4 and 5.8°C, depending on the emission scenario assumed and the model used.

Climate models are projecting significant warming and more extreme weather events

Recent research into some of the more complex climate processes, however, has suggested the possibility of larger increases for the same emission scenarios and an increased incidence of intense tropical cyclones and other extreme weather events. The findings of the 2007 IPCC report are expected to reflect these developments.

Some scenarios suggest the possibility of major irreversible changes which would have unpredictable global consequences, for example, the shut-down of the Gulf Stream, the thawing of the permafrost or the dieback of the Amazon forest.

Australia's climate is expected to become hotter and populated areas may become drier. CSIRO modelling[6] suggests temperatures in the southwest could increase by 0.5°C to 2°C by 2030 and by 1°C to 6°C by 2070, with rainfall declining by as much as 20% by 2030 and 60% by 2070 or (less probably) increasing by up to 5% by 2030 or 10% by 2070.

Australia's climate is expected to become hotter and populated areas may become drier. WA could be particularly vulnerable

WA would be very seriously affected by such changes. Reduced rainfall in the southwest has already led to a 40 to 50% reduction in water feeding into Perth's main water supply dams and further substantial reductions in inflow would have to be expected.

The current drought is having significant adverse impacts on regional WA and these are likely to be exacerbated with climate change.

Over the last five years, $78 million has been provided in direct drought assistance to businesses and families, with estimated production losses of around $550 million in WA areas declared to face 'exceptional circumstances'.

Table 1.1 Projected changes for inland areas of south-western WA (IOCI 2005)

Climate variable	2030	Mid-century
Mean summer temperature	+0.5˚ to +2.1˚C	Continued increase
Mean winter temperature	+0.5˚ to +2.0˚C	Continued increase
Mean winter rainfall	-2% to -20%	Continued decrease
Winter potential evaporation	+0% to +10%	Continued increase

Source: IOCI reports key findings of recent research into south-western climate, Bulletin No. 6, 15 August 2005

[5]IPCC, (2001). Third Assessment Report of the Intergovernmental Panel on Climate Change. Watson, R.T. and the Core Writing Team (eds.)]. Cambridge University Press. http://www.ipcc.ch/index.html

[6] Preston, BL and Jones, RN (2006), Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions, CSIRO Marine and Atmospheric Research

Indeed, recent modelling by the WA Department of Agriculture and Food[7] shows that if current trends continue as projected, cropping may become unviable over large areas, and farm profits in vulnerable eastern and north-eastern areas are likely to reduce by more than 50%. This will have major social and economic implications in affected areas.

As a result of historical emissions, we have already 'locked in' substantial global warming and sea level rise due to the significant lag time between emissions and climate change.

However, it is not too late for action. The extent of climate change will be determined by concentrations of greenhouse gases in the atmosphere. There is an emerging consensus that carbon dioxide concentrations significantly in excess of 450 parts per million by volume (ppmv) will lead to global mean temperature increases of greater than 2°C above present day values and increasing risk of 'dangerous' human interference with the climate system.

The climate is locked into some changes already but we can still act to limit the extent of the change

Figure 1.3 illustrates the likely range of global mean warming (above pre-industrial temperature levels) for stabilisation of greenhouse gases (expressed in terms of carbon dioxide equivalent) and the types of impacts to be expected for different amounts of warming. The top panel shows the range of temperatures projected at stabilisation levels between 400 ppm and 750 ppm $C0_2e$ at equilibrium. The solid horizontal lines indicate the 5 to 95% range based on climate sensitivity estimates from the IPCC 2001 and a recent Hadley Centre ensemble study. The vertical line indicates the mean of the 50 percentile point. The dashed lines show the 5 to 95% range based on eleven studies. The bottom panel illustrates the range of impacts expected at different levels of warming. The relationship between global average temperature changes and regional climate change is very uncertain, especially with regard to changes in precipitation. This figure shows potential changes based on current scientific literature.

[7]Climate Change, Vulnerability and Adaptation for South West Western Australia 1970 to 2006: Phase One of Action 5.5, State Greenhouse Strategy Report to the Western Australian Government and Australian Greenhouse Office, October 2006

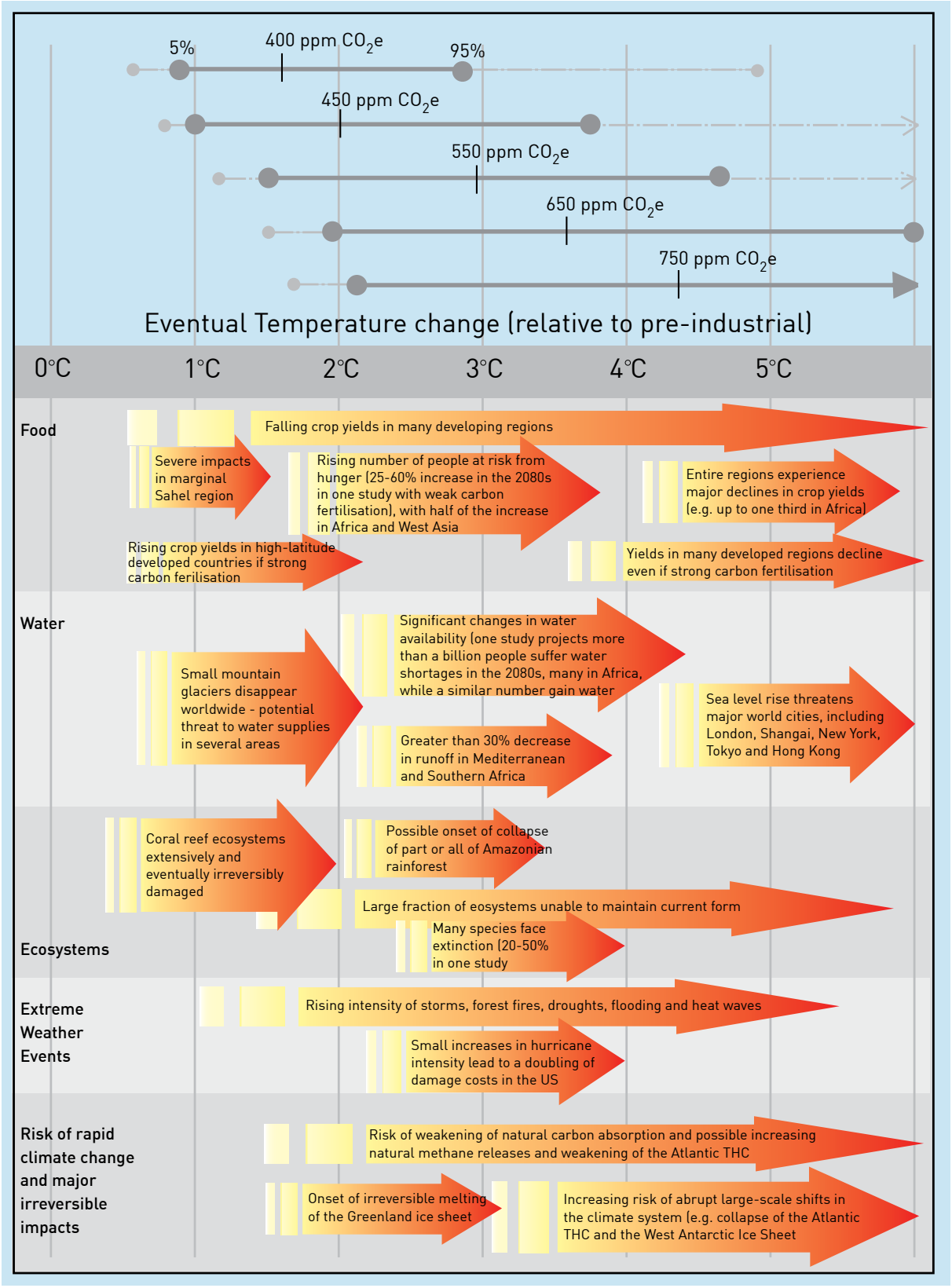


Figure 1.3 Stabilisation levels and probability ranges for temperature increases

Source: Stern Review 2006, The Economics of Climate Change, www.hm-treasury.go.uk

Avoiding dangerous climate change will require significant global emission reductions

In order to stabilise carbon dioxide concentrations at or below 450 ppm and avoid dangerous 'anthropogenic interference with the climate system' [8], it will be necessary to reduce global emissions to less than 50% of 1990 levels by mid-century and up to 80% by the end of the century. Because greenhouse gases have the same impact regardless of where they are emitted, any solution to climate change will need to be global, with the participation of all countries.

The Taskforce recognises the imperative of a global effort to reduce greenhouse gas emissions to a rate that will stabilise atmospheric concentrations at a level that would avoid 'dangerous' human interference with the climate system.

1.3 The international response

The global community has been grappling with the issue of climate change for many decades. The United Nations Framework Convention on Climate Change[9] was signed by 155 countries (including Australia) at the Rio Earth Summit in 1992 and is the overarching framework for international negotiations.

The Convention aims to achieve stabilisation of greenhouse gas concentrations 'at a level that would prevent dangerous anthropogenic interference with the climate system'[10].

In 1997, the Kyoto Protocol to the Framework Convention was agreed, with legally binding targets for industrialised countries to reduce emissions over the period 2008 to 2012. The Protocol came into force on 16 February 2005 (opening the way to international carbon trading) and, as of 18 April 2006, 163 countries had ratified. This compares with 150 countries that are members of the World Trade Organisation.

Australia, the United States, Croatia, Zambia and Kazakhstan are the only signatories of the Framework Convention that remain outside the Protocol. The frequently made claim that developing countries are not included in the Kyoto Protocol, or that they have no obligations, is incorrect, as major developing countries such as China and India are signatories and have committed to domestic action to reduce emissions.

The Kyoto Protocol and international emissions trading are now in operation – without the participation of Australia and the United States

India has a renewable energy target of 10% of new generation by 2012 (excluding large scale hydro power). China has a renewable energy target of 15% of all capacity by 2020 (excluding large scale hydro) and has implemented car fuel efficiency standards.

To contribute to efforts to meet its targets, the European Union (EU) has implemented an EU-wide emissions trading scheme. Canada also allows for credit trading in its National Plan. However, on current projections, the EU, Canada and Japan will all face significant shortfalls in achieving their Kyoto targets and will be relying on the trading provisions of the Kyoto Protocol to purchase credits on the international market. This is a potential

[8]UNFCCC Convention, Article 2: Objective (http://unfccc.int/essential_background/convention/background/items/1353.php

[9] http://unfccc.int/essential_background/convention/items/2627.php

[10]UNFCCC, Article 2

economic opportunity for Australia to provide offset projects such as tree plantations that could also remediate dryland salinity and land erosion and provide jobs in the regions.

Investment in long term emission reductions is constrained by uncertainty about the international framework post 2012. At the international negotiations in Montreal 2005[11] a 'twin-track' process was established in which targets for developed countries post 2012 are being considered under the Kyoto Protocol process, and other options are being explored under the Convention Dialogue.

Post 2012 uncertainty is resulting in limited investment in long-term reductions

The international debate currently centres on a few key issues about the nature of commitments under any global agreement, including:

- Whether to include specific quantified absolute emission reduction targets to be met in defined timeframes or rely on technology development and transfer;
- Any difference in the nature of commitments between developed and developing countries; and
- What role the United States will play in global efforts.

One key difference between various approaches is the relative focus on specific quantity reductions (e.g. the targets and timeframes approach of the Kyoto Protocol), market measures (e.g. Kyoto Clean Development Mechanism, EU Trading Scheme), and technology push (as favoured by AP6, see below).

In addition to formal negotiations, Australia is involved in a number of bilateral agreements; and a number of global processes are underway seeking to facilitate global climate action, including:

- The Gleneagles Dialogue on Climate Change, Clean Energy and Sustainable Development[12] launched at the G8 Summit in 2005, which includes cooperation with rapidly developing countries such as China, India, Brazil, Mexico and South Africa; and
- The Asia Pacific Partnership on Clean Development and Climate (AP6)[13] which includes Australia, USA, Japan, China, Republic of Korea and India, with a focus on technology development and transfer.

A number of additional processes have emerged to supplement formal negotiations

It is clear, however, that global reductions well beyond those envisaged in any of these current processes will be needed in order to meet the objectives of the Convention.

Despite the current difficulties in reaching global consensus on an appropriate response, there is substantial concern within the global community and negotiations on global action are likely to continue until the challenge of climate change is addressed.

There is significant action at national, regional and local levels

[11]Dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention. http://unfccc.int/meetings/dialogue/items/3668.php

[12]G8 Gleneagles Summit Communiqué: http://www.fco.gov.uk/Files/kfile/PostG8_Gleneagles_Communique,0.pdf; Climate Change, Clean Energy and Sustainable Development: http://www.fco.gov.uk/Files/kfile/PostG8_Gleneagles_CCChapeau.pdf

[13]http://www.ap6.gov.au/

Indeed, some of the widespread emission reduction activity includes:

- Seven US states setting limits and introducing emissions trading, and California aiming to cut emissions to 80% below 1990 levels by 2050;
- More than 650 members of Cities for Climate Protection;
- The EU emissions trading scheme, the climate change levy in the UK and trading of credits in Canada; and
- Renewable energy targets adopted by over 38 countries including UK (10% by 2010), Greece (20% by 2010), Sweden (60% by 2010), Germany (12.5% by 2010), France (21% by 2010) and Italy (25% by 2010).

In addition, an increasing number of multinational businesses are becoming vocal in the climate change debate, advocating global action to reduce greenhouse gas emissions. These include insurers such as Swiss Re and Insurance Australia Group, energy companies like BP and Shell and investors like Westpac and Goldman Sachs.

The Taskforce has concluded that global action to reduce greenhouse gas emissions is likely to continue and strengthen as the consequences of climate change become more evident.

It recognises that both technology push and market pull will be required to ensure technology deployment. However, the timing and the strength of a global framework are currently uncertain.

1.4 The national framework and priorities

Although the Commonwealth Government has indicated it will not ratify the Kyoto Protocol, it has committed to meet Australia's Kyoto target of constraining emissions to 108% of 1990 levels. Commonwealth Government projections suggest that Australia is on track to achieve this target, largely as a result of decreases in land clearing since peak rates of clearing in the late 1980s and early 1990s. Underlying emissions in other sectors are continuing to increase rapidly, particularly in stationary energy and transport.

Australia is on track to meet its Kyoto target, but is ill prepared for more significant longer term emission reductions

The Commonwealth Government approach to emission reduction has focussed on 'no regrets' voluntary action and funding for technology under initiatives such as the Greenhouse Gas Abatement Program and the Low Emissions Technology Development Fund.

A new focus on climate change under the Council of Australian Governments (COAG) is expected to progress predominantly existing initiatives, including a national system of emissions reporting and the national framework for energy efficiency.

State and territory governments have established the National Emissions Trading Taskforce (NETT) to investigate the development of an emissions trading scheme. This work will build on the achievements and experience of the NSW Greenhouse Gas Abatement Scheme, the Queensland 13% Gas Scheme and Victoria's 10% renewable energy commitment.

State Governments are working together on a national emissions trading scheme to provide a carbon price signal

The NETT recently released a discussion paper which sets out a possible scheme design and the outcomes of preliminary economic modelling[14].

The scheme proposes to cover only electricity generation initially, which accounts nationally for 50% of stationary energy emissions and around 35% of total national emissions. Two emission reduction scenarios are presented, which will bring national emissions from electricity generation to:

- 176 Mtpa (2000 levels) by 2030; and
- 150 Mtpa (1997 levels) by 2030.

The scheme design includes unlimited use of offsets as well as mechanisms to minimise the impact on those sectors of the Australian economy which are trade-exposed.

1.5 The WA approach to date

The WA Government has recognised the need to respond to climate change and released its Greenhouse Strategy in 2004[15] , which aims to reduce greenhouse gas emissions and take advantage of the opportunities generated by action on climate change. The Strategy will be revised in 2008.

The WA Greenhouse Strategy includes initiatives across all sectors

The Strategy sets out a range of initiatives with an emphasis on flexible market-based measures. A full list of measures is included in Appendix 3. Key initiatives relevant to the deliberations of the Taskforce include:

- A program of leadership to minimise government emissions through energy efficiency and purchase of renewable energy;
- Requirements for emissions reporting for large industrial emitters and the establishment of an emissions registry;
- A series of measures to better understand and encourage the development of carbon sequestration, in tree planting, revegetation and geological storage;
- A Greenhouse Unit to coordinate all WA climate change policy and report annually on implementation;
- Consideration of a national emissions trading scheme and a multi-state mandatory renewable energy target;
- Development of a renewable energy strategy to achieve a target of 6% renewable energy by 2010 and establish a target for 2020;
- Development of a Biomass energy strategy for regional areas;
- A Solar Schools Program to install solar panels in 100 schools; and
- Powering WA's desalination plant by renewable energy.

The Taskforce was established to advise Cabinet on long-term emission reductions

The Greenhouse and Energy Taskforce was established on 30 May 2005 to provide advice to the WA Cabinet on practical and economically feasible policies to manage emissions from the stationary energy sector and the feasibility and implications of reducing emissions by 50% by 2050.

The full terms of reference are included at Appendix 1.

[14]National Emissions Trading Taskforce (2006), Discussion Paper: Possible Design for a National Greenhouse Gas Emissions Trading Scheme, http://www.emissionstrading.net.au/__data/assets/pdf_file/2017/Discussion_Paper_-_Full_document.pdf;

[15]Western Australian Greenhouse Strategy (2004) Prepared by the Western Australian Greenhouse Task Force.

In addition, the Government instructed the Taskforce that:

- Nuclear energy was to be excluded from consideration; and
- 1990 stationary energy emissions are the 'baseline' for analysis.

The definition of stationary energy is that used by the Australian Government in its National Greenhouse Gas Inventory, and summarised as 'fuel combustion to provide energy for energy industries, manufacturing and construction industries and other sectors excluding energy used for non military transportation' [16].

While falling outside the strict definition of stationary energy, the Taskforce also considered fugitive emissions due to their close relationship with the stationary energy sector and their significant implications for WA emissions.

1.6 Proposed approach to policy development

WA has a small absolute level of emissions and a high proportion of trade exposed, energy intensive industry. Injudicious unilateral action could damage the WA economy with little impact on global reductions of greenhouse gas emissions.

WA can enhance the prospects for a global solution while preparing the economy for future constraints

Only a global solution can reduce emissions sufficiently to avoid the most adverse impacts of climate change and protect the population, environment and economies of WA, Australia and the world. The alternative to a global solution is an unacceptable risk of severe global impacts.

The rationale for WA action is therefore to enhance the prospects of a global solution, and to influence the process while ensuring that WA is not unfairly disadvantaged in terms of its development and living standards.

The Taskforce considers that WA should therefore decide to:

- Develop policy based on the assumption that a global solution will be implemented, and fully support and participate in that solution in a timely manner;
- Identify all measures which the State can adopt to reduce emissions and their economic costs;
- Take measures to ensure that investments and development in the WA economy anticipate the need for deep cuts in greenhouse gas emissions under a global approach, so as to manage the risks of likely significant future carbon prices;
- Progressively implement proactive measures which keep pace with global developments, recognising that these are likely to incur increasing economic costs; and
- Ensure that the state is positioned to provide leadership and support for a viable global approach.

Policy aims must balance long-term environmental and short-term economic outcomes in a highly uncertain political and economic setting. Policies need to be chosen now that will steer activity today in the right direction at the right speed as best as can be judged.

[16] p 6: http://www.greenhouse.gov.au/inventory/2004/pubs/inventory2004.pdf

Policy must aim to achieve environmental and economic objectives and provide flexibility in an uncertain environment

Policy will need to be adjusted as information and external circumstances change and the effectiveness of policy is assessed. While there is a case for early action on the basis that this will minimise costs, this needs to be balanced against the greater certainty that comes with better information.

Rational unilateral emission abatement policy is all about positioning for increasing global action and will necessarily include:

- Driving an agenda to secure sustainable global action to reduce emissions drastically;
- Applying 'no regrets' measures, such as increasing energy efficiency, where there are considerable economic opportunities;
- Identifying and harnessing new economic opportunities that arise from global action;
- Using supply side measures, such as government support for greenhouse-friendly research and development; and
- Providing carbon price signals to investors to encourage investment in low emission technologies and to avoid investment in costly long-lived assets that may become stranded.

The Taskforce believes that global action will continue and strengthen and has therefore recommended a range of policies and measures to reduce greenhouse gas emissions. Some of the measures are 'no regrets' and can be implemented at little or no cost, often with economic benefits from emission reductions. Others, however, will involve more significant economic costs.

RECOMMENDATION 1

The Taskforce recommends that the WA Government set policy goals for action to reduce greenhouse gas emissions as follows:

i. To maximise the chances of success of international efforts to prevent dangerous and costly climate change;

ii. To reduce emissions in ways that avoid severe or seriously inequitable economic impacts on WA industry or the community and avoid stranded assets;

iii. To limit the expense to WA taxpayers to that which is reasonable, cost-effective and equitable in the context of global initiatives; and

iv. To review progress regularly and incorporate additional measures as they become appropriate in the national and global context.

Costs of different technologies will also vary over time reflecting the various stages of technological development and economies of scale. Current high cost options may become considerably less costly over time. The Taskforce commissioned a number of reports to inform its deliberations and a list of these is included in Appendix 4.

A recent Climate Group report Carbon Down, Profits Up[17] outlined how a select group of companies and governments had successfully reduced their greenhouse gas emissions and achieved financial and economic benefits as a result, with gross savings of US$11.6billion. In particular, four companies - Bayer, British Telecom, DuPont and Norske Canada - achieved absolute emission reductions of 60% or more with total gross savings of $US4 billion. The

[17]The Climate Group (2005) Carbon Down, Profits Up Second Edition: http://www.theclimategroup.org/assets/CDPU_2005_v2.pdf

Climate Group is an independent, non-profit organisation dedicated to advancing business and government leadership on climate change.

Policies and measures adopted in the stationary energy sector will need to be considered in the context of economy-wide objectives. While the Taskforce has focussed on the stationary energy sector, it recognises that greenhouse gases are emitted across the economy, and emission reduction opportunities exist across a very wide range of sectors, technologies and practices.

A comprehensive approach is needed to ensure economy-wide objectives are met efficiently

Because of the wide range of abatement costs, capacity and availability in each sector, a strategy to equalise the marginal costs of abatement across sectors will assist the WA Government to deliver economy-wide objectives at the lowest cost and in the most equitable manner.

An economy-wide approach would include a range of compatible, flexible and periodically adjusted measures to maximise efficiency and effectiveness.

Furthermore, it is essential that climate change policies are consistent with other government policies, in order to exploit synergies and avoid conflicts. Relevant policy areas include:

- Energy policies - security, reliability, safety, competition, price, energy efficiency;
- Industry policy - major project investment, energy costs and competitiveness, energy exports, innovation, sunrise industries, renewables;
- Social policies - jobs, regional development, energy access and costs for low income groups, health, emergency services and disaster recovery; and
- Environment policies - air quality, land planning, waste, salinity, biodiversity.

WA therefore needs highly expert, ongoing government institutions and processes with the capacity to manage this policy development and integration task.

Policy instruments fall essentially into four categories:

- Regulatory measures which set minimum standards or requirements (e.g. emission reporting, absolute or intensity-based emission limits);
- Market-based measures which provide economic incentives and/or price signals for reducing emissions beyond minimum standards (e.g. emissions trading);
- Fiscal measures such as taxes, rebates or subsidies; and
- Voluntary measures which help build awareness and capacity (e.g. The Greenhouse Challenge).

Each has a place in achieving mitigation targets, although the distinction between the categories is not always clear and the policy design will depend on the specific policy challenges it seeks to address. There are many barriers to less greenhouse intensive activities which include cultural, institutional, informational and financial barriers. Different policy mechanisms will be needed for each of these.

The recommendations in this report are designed to prepare the WA economy for national and international carbon price signals, which are already playing a significant role and are likely to become pervasive and decisive, and to remove some of the other non-financial barriers to the use of low emission technologies.

Market-based measures are best supported by complementary, regulatory and voluntary measures

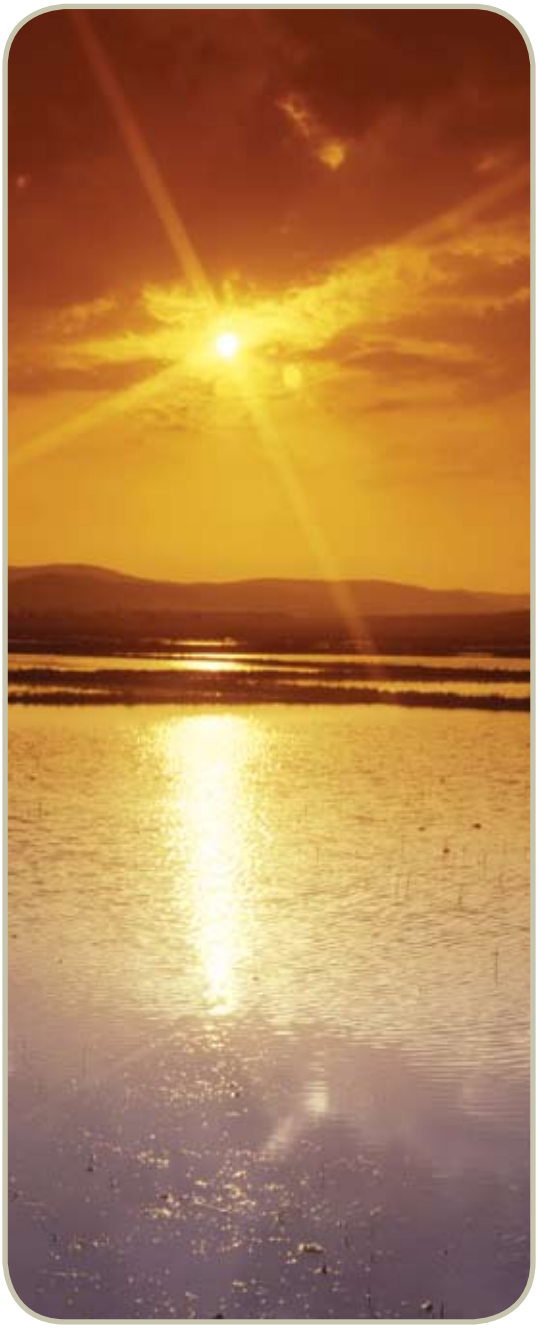
The current lack of a 'bankable', long-term price signal is widely recognised as a significant barrier to the deployment of low emission technologies and emissions trading has been recognised as a market-based mechanism that could provide a broad economy-wide price signal. However, it will still require complementary measures to ensure other non-price barriers are overcome, including institutional, cultural and information barriers.

The prime requirement is that whatever instruments are in place are well coordinated, complementary and assessed regularly and rigorously to determine whether they are achieving the desired outcomes, and what adjustments or improvements might be needed.

It is imperative that WA improve its capacity and expertise in greenhouse policy, to ensure its policies and programs are focussed and effective in meeting the State's requirements and that WA maintains a cutting edge capability in responding to issues and opportunities.

RECOMMENDATION 2

The Taskforce recommends that the WA Government strengthen government capacity and expertise in greenhouse policy development commensurate with the increasing priority of the issue.



2 The current WA outlook

2.1 Overview of the WA economy and the stationary energy sector

The economy is undergoing a boom driven by high global demand and prices for its main export products. In the five years to 2005-06 its real Gross State Product (GSP) increased at an annual average rate of 5.6% - more than any other State or Territory, and well ahead of national economic growth of 3.3% a year.

The WA economy is booming and emissions are growing

Western Australia is a major exporter of commodities to the rest of the world. WA supplies 17% of alumina, 17% of iron ore and 55% of tantalum to the world market[18] and significant market shares in other products. Demand growth is expected to continue into the future.

In 2005-06 Western Australia's GSP was worth almost $120 billion, and its per-capita GSP of $58,688 was 24% higher than the national

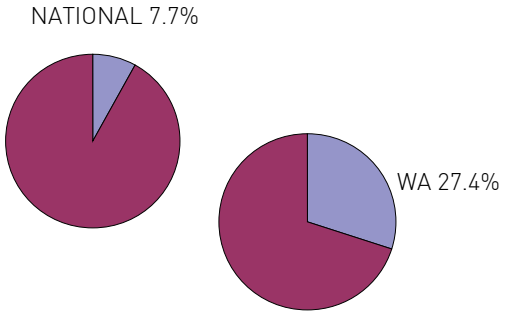


Figure 2.1 Mining share of the economy

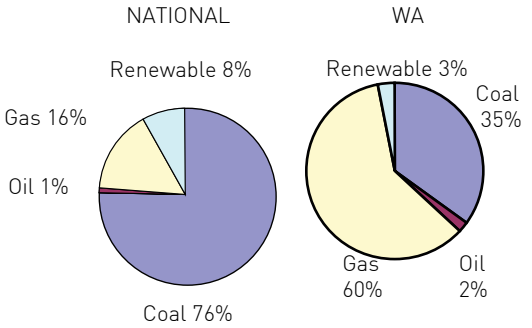


Figure 2.2 Electricity generation by fuel type

average, and higher than any other State (though not the Territories).

Western Australia, with 9.9% of national population, accounts for 33% of goods exported and 12.3% of the nation's economic output.

In 2005-06 the mining industry accounted for 27.4% of Western Australia's income by industry, compared to 7.7% Australia-wide. The importance of mining has increased rapidly in the past two years as the sector expanded in response to growth in global commodity prices and demand.

Manufacturing and construction each contribute about 8% of the State's factor income, and agriculture and electricity, gas and water each account for 3%. Like mining, these sectors are relatively intensive greenhouse gas emitters.

Electricity generation in WA is generated via a mixture of gas, liquids, coal and, to a lesser extent, renewables. Currently, gas fired power generation dominates. Indeed, WA has the highest gas share of primary energy use of all Australian states, which is expected to further increase. Around 60% of WA generation capacity is currently government-owned, most of which is located in the southwest.

Electricity in the southwest of WA is delivered via the South West Interconnected System (SWIS), which stretches from north of Geraldton as far south as Albany and east to

[18]Department of Industry and Resources, March 2005

Kalgoorlie. Three government-owned utilities have responsibility for various part of operation within the SWIS:

- Verve Energy - generation via a fleet of coal, gas and liquid fuelled power stations;
- Synergy - retail supplier of electricity; and
- Western Power - responsible for transmission and distribution.

While Verve Energy has the largest portfolio, with 3,400 MW of capacity, there are also significant private generators such as Alinta, NewGen Power and Griffin Power which collectively have another 1,200 MW of capacity.

The Independent Market Operator (IMO) conducts annual generation forecasts to identify opportunities within the SWIS. The IMO's latest Statement of Opportunities suggests that maximum demand will increase from 3,541 MW in 2006-07 to 4,858 MW in 2015-16, a simple annual growth rate of 3.7%. Sent out energy is forecast to increase at a lesser rate, from 15,400 GWh in 2006-07 to 19,874 in 2015-16 or growing at 2.9% annually.

Other gas use in WA is primarily industrial, with more limited residential use. Most private generation uses gas.

2.2 WA historical emissions 1990 to 2004

In 1990, WA was responsible for 57.3 Mt of greenhouse gas emissions from all sources, 10.4% of the national total. By 2004, WA emissions had increased to 68.5 Mt, or 12.1% of national emissions[19].

WA has among the highest per-capita emissions in the industrialised world. Its emissions profile is different from most other developed economies because a significant proportion of emissions are generated in the production of energy and raw materials for use in other countries.

Stationary energy emissions in WA were 22.6 Mt in 1990 and 36.6 Mt in 2004. Indeed, stationary energy emissions account for around half of WA emissions and an even greater proportion of emissions growth.

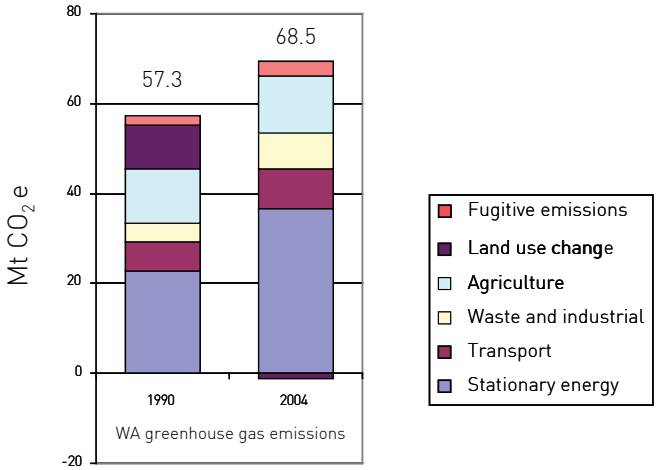


Figure 2.3 WA greenhouse emissions

2.3 WA stationary energy emission projections

The best available estimates from ABARE[20] are that, under current policy settings, greenhouse gas emissions from stationary energy would increase from 40 Mt in 2004-05 through to 71 Mt in 2029-30, an increase of around 80% (average of 1% per annum) or 189% above 1990-91 levels of 25 Mt.

Forecasting emissions decades into the future is inherently difficult, but present best estimates suggest considerable growth to 2050

[19]Australian Greenhouse Office (2005) 'State and Territory Greenhouse Gas Emissions – An overview', http://www.greenhouse.gov.au/inventory/stateinv/index.html

[20]Riwoe, D., Cuevas-Cubria, C. and Akmal, A. (2006) A Review of Energy and Greenhouse Gas Emission Projections for Western Australia, ABARE Report. Prepared for Western Australian Greenhouse and Energy Taskforce.

These projections are used in Taskforce deliberations as a basic case scenario that reflects (to the extent that such a concept is realistic) business-as-usual. Although it is extremely unlikely that current business-as-usual policy settings will remain unchanged, the ABARE forecasts represent the most useful baseline available against which to assess the impact of new policies.

Figure 2.4 shows historical emissions, ABARE projections to 2030 and straight line extrapolation to 2050. The chart also includes uncertainty assumptions of +/-5% at 2010, +/-10% at 2020 and +/-15% at 2030.

Modelling beyond 2030 is of limited accuracy and emissions projections will be subject to a range of sensitivities, but extrapolation of the figures from 2004-05 through 2029-30 gives indicative 2050 emissions between 72 Mt and 120 Mt.

Appendix 5 provides further information on uncertainty in emissions forecasting and projection for WA.

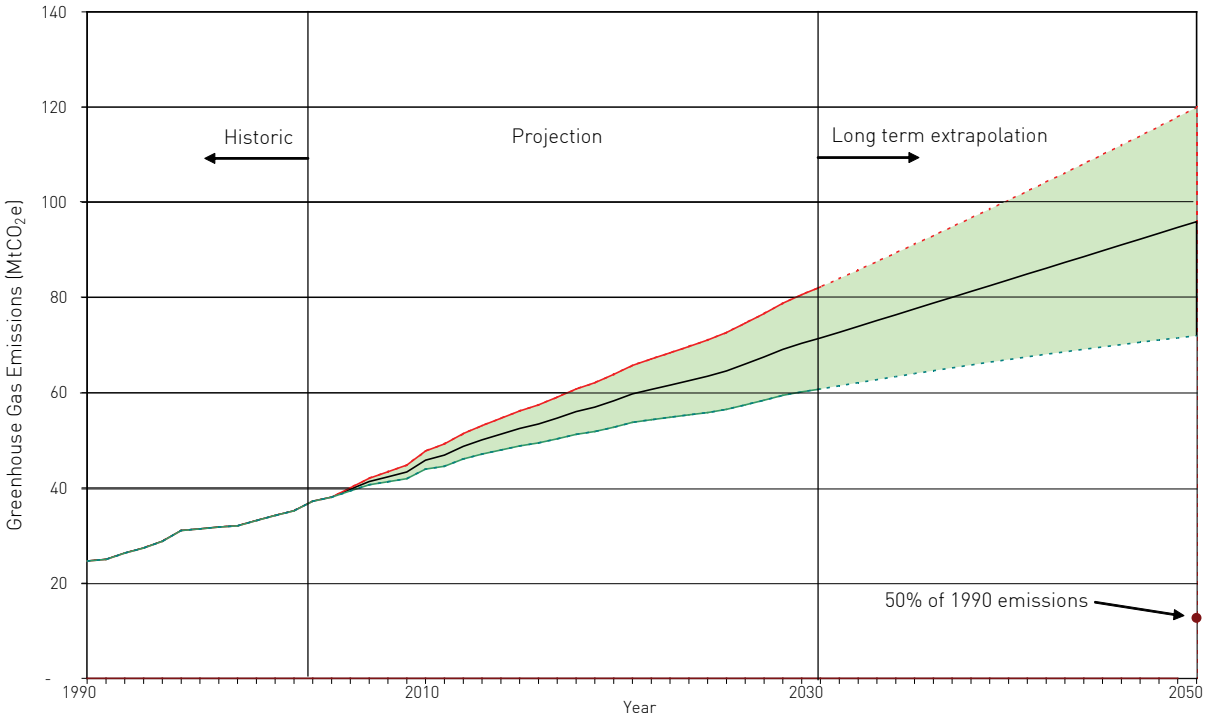


Figure 2.4 Historic and 'business-as-usual' WA stationary energy greenhouse gas emissions 1990 to 2050

Source: Adapted from ABARE (2006)

As with any modelling exercise, these results are a function of the assumptions made and therefore sensitive to any changes in those assumptions. These sensitivities include:

- economic growth rate: ABARE has assumed an economic growth rate of 3.7% per year over the period, but recent experience suggests that continued growth of 4.5% annually could be plausible which would further increase emissions;
- energy intensity of the State's economy; and
- carbon intensity of electricity generation, in particular the mix of gas versus coal and role of renewable energy.

In addition, a relatively small number of major projects may have significant implications for future emissions and there is necessarily significant uncertainty in timing and ultimate development of many of the prospective major industrial developments.

There are considerable variations in rates of emissions growth between sectors. Table 2.1 shows stationary energy emissions by sector in 1990 and in 2030 (the last year of the projections) and the total percentage increase over the period.

Stationary energy emissions growth is dominated by mining, alumina and other manufacturing

Table 2.1 ABARE projections of stationary energy emissions by sector

Sector	Emissions ($kt CO_2e$)		Share (%)		Increase 1990 to 2030 (%)
	1990-91	2029-30	1990-91	2029-30	
Agriculture	559	1,346	2%	2%	141%
Mining	3,846	22,564	16%	32%	487%
Manufacturing and construction	7,963	16,635	32%	23%	109%
Electricity generation	11,293	28,445	46%	40%	152%
Commercial and services	315	806	1%	1%	156%
Residential	628	1,193	3%	2%	90%
Other	30	162	<1%	<1%	439%
Total	**24,634**	**71,152**			**189%**

Source: ABARE (2006)

Electricity generation is currently the largest contributor to stationary energy[21], contributing approximately 40% of stationary energy emissions. However, mining (including liquefied natural gas - LNG) shows the largest projected increase of nearly 500% between 1990 and 2030.

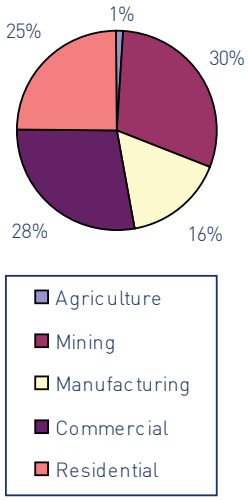


Figure 2.5 Electricity emissions by end use (2003-04)

Source: ABARE

The development of gas fields for LNG export is one of the most significant drivers for emissions growth in WA, in terms of both energy use and increasing fugitive emissions.

Figure 2.5[22] shows the allocation of greenhouse gas emissions derived from electricity generation to those sectors consuming the electricity. These figures are based on apportioning electricity generation by consumption over the total electricity generation and assume that each sector takes an equivalent generation mix according to its electricity needs.

The mining, manufacturing, commercial and residential sectors each account for a significant share of electricity use and should therefore be a focus in the development of energy efficiency programs that target electricity use. Agriculture is responsible for a tiny fraction of electricity use.

2.4 Fugitive emissions

In this report, the term 'fugitive emissions' is used to cover gas which leaks or is vented into the atmosphere without combustion and CO_2 which is naturally present in the reservoir and which is released into the atmosphere when gas is utilised. This is additional to the CO_2 produced by combustion of the produced gas.

The accepted definition of emissions related to stationary energy does not include fugitive emissions. The Taskforce has given them separate consideration due to their significance in Western Australia. For clarity and in order to maintain consistency of stationary energy figures elsewhere in this report, the information and recommendations on fugitive emissions is only included in this section and in Section 3.3.

Fugitive emissions are of critical importance in considering WA emissions

CO_2 levels in currently producing gas fields are low by global standards (1 to 3% CO_2 by volume). However, gas fields which are currently planned and proposed for development have significantly higher CO_2 levels (8 to 17%).

[21]Riwoe, D., Cuevas-Cubria, C. and Akmal, A. (2006) A Review of Energy and Greenhouse Gas Emission Projections for Western Australia, ABARE Report. Prepared for Western Australian Greenhouse and Energy Taskforce.

[22]Ibid.

The processes associated with the manufacture of liquefied natural gas (LNG) require the removal of produced CO_2 prior to the final hydrocarbon liquefaction stage. Once captured, there is an opportunity to dispose of this produced CO_2 by geo-sequestration thus avoiding further fugitive emissions. This involves reinjection of CO_2 into a suitable geological structure where there is a high level of certainty regarding long-term containment. This process is costly and has not been employed before in WA, and only on an experimental basis elsewhere in the world. It is, however, seen as critical developing technology for the hydrocarbon industry.

Fugitive emissions in WA are expected to increase significantly from the 2003-04 level of around 1.5 Mtpa to 8 Mtpa by 2030 as a result of general increases in gas production through existing facilities and directly to domestic users.

In addition, a number of large LNG projects are being planned. Gas fields associated with the Gorgon LNG project contain CO_2 levels of 12 to 15% and Gorgon is currently considering CO_2 sequestration.

Figure 2.6 shows expected fugitive emissions based on the assumption that a large proportion of emissions from the Gorgon development will be sequestered while there would be no sequestration from Browse.

The large degree of uncertainty associated with these sequestration and development assumptions means that significant uncertainty bands of +20/-40% at 2010, +20/-50% at 2020 and +30/-60% at 2030 have been adopted in Figure 2.6. Further information on these uncertainty bounds can be found in Appendix 5.

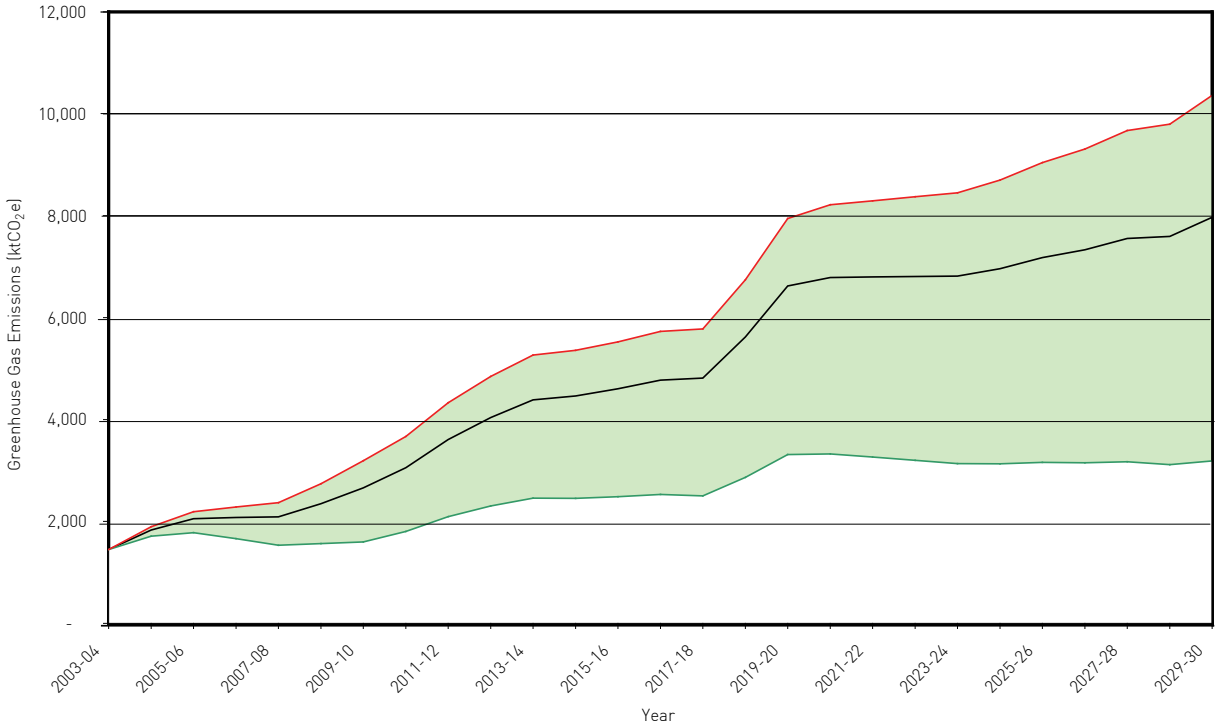


Figure 2.6 Projected Western Australia fugitive emissions (venting and flaring)

Other large gas fields which have been discovered and are awaiting development as LNG feed stock also contain significant levels of CO_2. ABARE[23] has estimated that fugitive emission levels for WA could rise to 13.5 Mtpa if geo-sequestration is not pursued. This could be substantially exceeded if LNG developments are accelerated. Conversely, sequestration of Browse as well as Gorgon would see 2029-30 fugitives of 6.6 Mt.

These potential fugitive emissions result from a small number of major developments and it is clear that decisions made with regard to geo-sequestration as part of the environmental approvals for each project will have a very significant impact on WA's overall emission levels.

It should be noted that these large fugitive emissions are in addition to the combustion emissions which result from the processing of LNG which are of a similar order of magnitude.

[23] Riwoe, D., Cuevas-Cubria, C. and Akmal, A. (2006) A Review of Energy and Greenhouse Gas Emission Projections for Western Australia, ABARE Report. Prepared for Western Australian Greenhouse and Energy Taskforce.

3 Abatement potential

Technology and policy responses to climate change are evolving rapidly. Companies, countries and regions need to anticipate and prepare for change if they are to benefit from a smooth economic transition to inevitable future carbon constraints.

By combining cost-effective energy efficiency improvements, lower emission energy supply options and a $25/t carbon price, emission reductions of up to 50% below stationary energy sector business-as-usual emissions in 2030 are feasible.

Significant emission reductions can be gained at low or no cost through targeted energy efficiency investments and stationary energy generation decisions

However, widespread deployment of energy efficiency or lower emission technologies is unlikely without either mandatory requirements or a carbon price signal.

Investment in new electricity generation infrastructure and other energy supply technologies typically have a long-term operational life, measured in decades. Hence promoting early uptake of energy efficient and low emission technologies and deferring long-lived investments in assets with high greenhouse exposures is a responsibly prudent strategy for WA. Particularly with the inevitability of emissions trading and a price on carbon.

3.1 Overview of technical opportunities for emission reductions

Energy efficiency improvements

A report prepared for the Taskforce (Insight Economics[24]) identified considerable opportunities for improvements in energy efficiency in the short to medium term in seven sectors: mining, basic metals, iron and steel, non-ferrous metal, non-metallic minerals, commercial and residential. Around 85% of the identified savings are available from three sectors: mining, commercial and residential. These sectors should therefore be priorities for action.

The expected savings in energy use and consequent reductions in greenhouse gas emissions are detailed in Section 3.2. It should be noted that these savings are not predicated on any major technological breakthroughs but rather on incremental improvements. For example, in the mining sector the improvements are linked to installation of high efficiency motors and variable speed drives, to improved and optimised process control, and to improved management and enhanced management systems[25].

In the commercial and residential sectors, as well as behavioural change and better awareness of energy savings measures, there is scope for improved technology and control, particularly in lighting and air-conditioning systems, improvements in building design, insulation and sealing, and higher efficiencies in a whole range of appliances.

[24]Insight Economics (2006) Energy Efficiency: Policy Measures to Reduce Greenhouse Gas Emissions. Prepared for the WA Greenhouse and Energy Taskforce.

[25]Energetics (2006), Energy Efficiency Potential in Western Australia. A report to the WA Greenhouse and Energy Taskforce.

Lower emission energy supply options

A range of existing technologies can already significantly reduce emissions at low or no cost and emerging technologies will add to emission reduction options and achievements. Work commissioned by the Taskforce suggests that applying policies that promote early uptake of these technologies in WA could yield large benefits, both in reducing end use energy demand and consumption and in reducing greenhouse gas emissions from energy generation plant.

Section 3.3 considers the emission reductions which could be achieved from existing technologies, and the potential for further reductions as a consequence of developing technologies which the Taskforce believes have a good prospect of being in place in the next 20 years or so. It also discusses where WA should consider investing its resources, with particular reference to research and development.

Emerging options to capture and store emissions are addressed in Section 3.6; this is of particular relevance if coal is to remain viable as a fuel in a low emission environment.

Table 3.1 summarises the greenhouse gas abatement measures for WA on a geographic basis and earliest availability.

Combined Cycle Gas Turbine

Combined cycle gas turbines (CCGT) are conventional power generation technology in widespread global use that integrates a gas combustion turbine with a steam turbine to capture the exhaust heat from the gas turbine and achieve higher efficiencies.

Under the ABARE scenario, about 75% of new generation to 2030 is gas-fired with efficiencies consistent with that of CCGTs. Several CCGTs are already in operation or proposed in WA.

Table 3.1 Greenhouse gas technological abatement measures by WA regions and availability

	Immediate 2006-2010	Short-term 2010-2020	Long-term 2020-2050
Coastal	End-use Efficiency Wind	Wave Tidal	
Southwest interconnected grid	End-use Efficiency Natural gas switching Wind	Geothermal Wave	Carbon Capture and Storage Solar gas reforming Hydrogen combustion engines Fuel Cells (Fusion – after 2050)
Northwest	End-use Efficiency	Carbon Capture and Storage Geothermal Wave and tidal	Solar gas reforming Hydrogen combustion engines
Regional WA	Wind End-use Efficiency Biomass	Solar thermal and PV Clean coal	Hydrogen combustion engines Fuel cells

Source: DrJ Patroni, Technology Outlook for Stationary Energy in WA (2005)

Solar

Photovoltaics

Electricity derived from the direct conversion of light by semiconductors is termed photovoltaic (PV) power. Total global PV capacity is in excess of 1400 MW and deployment rates are growing at 15% annually. Funding schemes and feed-in tariffs to power grids have played an important role in the development of PV industries in many countries.

Currently, PV systems are costly relative to other options, but technological developments are expected to make these systems more competitive.

PV electricity generation operates at low efficiencies (6 to 15%) but offers several benefits as a developing distributed generation technology where it readily integrates into urban landscapes; reduces electricity infrastructure costs and investment; assists in securing energy supplies; offers low operating and maintenance costs (1 to 3% of capital); and operates at near zero greenhouse emissions.

The Commonwealth's Photovoltaic Rebate Program was established, in 2001, and extended in 2005 until June 2007, to generate some 11,000 PV installations. It offered a rebate of $4.00/peak Watt of installed PV capacity up to a cap of $4,000 per householder[26]. Total installed PV power in Australia is now about 40MW with 89% off-grid and 65% dedicated to non-domestic uses. The balance, equivalent to some 10,000 domestic residents have PV systems installed.

With access to vast areas of high solar flux, solar electricity is acknowledged as having significant potential to provide electricity for Australia. According to the PV Industry Roadmap, Australia could install capacity of 6,700 MW by 2020[27].

High solar fluxes make PV systems well suited to off-grid regions of WA

The vast remote regions of Western Australia that do not have access to grid infrastructure are particularly suited to PV systems. However, off-grid PV capacity remains relatively small with a 31 kW installation in Hamersley in 2005 and a 32 kW installation in Laverton in 2006 [28].

Concentrating solar power for both thermal and PV applications

There are various means of concentrating solar energy to improve efficiency of solar systems, including thermal and PV generators. Currently, the International Energy Agency (IEA) estimates that concentrating solar power (CSP) at optimum locations on either side of the Earth's equator costs US$0.10 to 0.15/kWh, or $0.13 to 0.20/kWh, with targeted future reductions to US$ 0.05 to 0.08 over 10 years [29].

In targeting solar power costs at $0.05/kWh by 2025, a private Victorian company, Solar Systems, with support from $75 million Low Emissions Technology Development Fund (LETDF) grants announced in October 2006 [30], will build a $400 million, 154 megawatt power station which is expected to generate annually 270,000 MWh, sufficient for 45,000 homes in the Mildura region. The facility uses sun-tracking mirrors (heliostats) to concentrate sunlight onto PV arrays from six large areas covering 600 ha to 800 ha. The first power will come on stream in 2008 and reach full capacity by 2013.

[26]http://www.greenhouse.gov.au/renewable/pv/index.html

[27]http://www.bcse.org.au/docs/Publications_Reports/PV%20Roadmap-web.pdf

[28]http://www1.sedo.energy.wa.gov.au/pages/waproj.asp

[29]International Energy Agency (2006) Energy technology perspectives 2006- scenarios and strategies to 2050, Chapter 4, p 227.

[30]http://www.ausindustry.gov.au/content/content.cfm?ObjectID=ACCA1CF7-5900-4367-AA43BE6D0323ECD6&L2Parent=0786C9BE-08B7-4973-93429A645AEEC8E4&L3Parent=61B11DDD-1A32-42EE-9827BD5C63DE326D

Current solar thermal plants in operation achieve costs of $0.16/kWh, the lowest of any solar technology, and can be combined with fossil fuel-fired boilers to deliver power at $0.10/kWh. Solar thermal energy can also be applied to methane reforming process incorporating 26% of the solar energy into the product gas.

Wind

IEA member countries increased wind power capacity from 2.4 GW in 1990 to 28.1 GW in 2002. This represents a sharp annual growth rate of 23% over 12 years, with US$7.3 billion of wind projects being built in 2002 alone. Driven by increasing natural gas prices, the US installed a further 2500 MW of wind power in 2005-6, and some suggest that wind energy could contribute 6% to the US energy mix by 2020 [31]. Wind energy installed costs have steadily reduced by some 5% per annum and are expected to reduce further as technology refinements and installed capacity grow. The IEA advises that the most cost effective plants now produce power at US$0.03 to 0.04/kWh or $0.04 to 0.05/kWh[32]. Further technological gains, particularly in power management, are expected to deliver better cost outcomes in the future.

Wind energy is currently the lowest cost renewable energy resource

In Australia, 184 MW of wind capacity was installed to 2004, generating enough energy for some 83,000 Australian homes. It is understood that there is a further 2,800 MW (enough for over half a million households) of wind generation in the planning stages requiring a $5 billion investment.

Australia's first commercial wind power farm was constructed by Western Power at Esperance in 1993, followed by the then largest wind farm at Albany in 2001. A world-first wind-diesel hybrid system has since been installed at Denham which caters for the intermittency of wind. Western Australia has currently installed about 195 MW of wind power generating capacity.

Clean coal

Higher thermal efficiencies are the most practical way of reducing CO_2 emissions for the coal industry. CSIRO's summary in Figure 3.1 depicts the quantifiable reductions in emissions resulting from the improved efficiencies offered by the various clean coal processes. However, there remains a significant gap in emissions when compared to the gas turbine processes. The other option for reducing emissions is through carbon capture and storage, which is discussed in Section 3.6.

Higher efficiencies will reduce emissions from coal-fired power plants, but the emissions are still higher than gas-fired power plants

According to CSIRO Energy Transformed Flagship's research into low emission electricity, future technological developments include:

- the widespread retrofitting of post combustion capture equipment on existing coal fired power stations commencing from 2010;
- the widespread introduction of clean coal technologies such as integrated gasification combined cycle power plants commencing between 2010 and 2020; and
- the development of viable sequestration methodologies for commercial introduction within the next 20 years.

The Commonwealth will provide $50 million from the LETDF to Queensland government corporations, CS Energy and Stanwell, along

[31]Eckhart M, "Renewable energy industry: 2005 review/2006 outlook" Power Eng., 2006, 110(1), 8.

[32]International Energy Agency (2006) Energy technology perspectives 2006- scenarios and strategies to 2050, Chapter 4, p 227.

with project partners for a world-first oxy-fuel demonstration project to retrofit one of the power plants at Callide A to oxy-firing. Project partners include the Cooperative Research Centre for Coal in Sustainable Development (CCSD) and the Cooperative Research Centre for Greenhouse Technologies (CO_2CRC). The $188 million demonstration project will commence in 2007 and be completed by 2015. The resulting exhaust carbon dioxide will be captured, liquefied, transported and stored underground (geo-sequestration) at drilling test sites within 350 km in the Springsure/ Emerald area.

In 2006, the Commonwealth granted $50 million towards a $360 million pilot for a brown coal drying and a post-combustion carbon dioxide capture and storage project at International Power's Hazelwood facility in Victoria; construction will begin in 2007 with completion by the end of 2009 [33].

Geothermal (Hot dry rock)

Hot dry rock geothermal results from the decay of radioactive isotopes in granite located 3 km or more below the surface. The result of this decaying process is the release of significant amounts of heat energy which is then trapped by other rock structures located above and acting as an insulating blanket. This can be used to superheat water by pumping it down to and through the hot rocks at depth. The water can then be used to drive conventional electricity generator turbines through direct conversion to steam or through secondary steam generation via a heat exchanger. It provides base load power with no greenhouse gas emissions. Hot dry rock technology is still in its experimental and demonstration stages.

According to the Australian National University, there are significant reservoirs of geothermal energy from hot dry rocks in Australia [34]. While good geothermal sites appear more limited in Western Australia, the best locations for potential sites are those in close proximity to the electricity grid and electrical load such as within the Perth Basin.

Geothermal energy would provide baseload power and WA should evaluate its potential

Given its potential, it is surprising that there are no geothermal energy developments underway as yet in Western Australia and a detailed evaluation of any impediments is required.

Fuel cells

Fuel cells comprise electrochemical reactions where energy resulting from a fuel oxidation is converted into electrical energy. In an organic/ air fuel cell, electricity is produced when fuel such as methanol, formaldehyde or formic acid is oxidised to carbon dioxide at an anode, while air or oxygen is reduced to water at a cathode. Conceptually, the process may be reversed by applying electricity to produce methanol from CO_2 and water and serve as a method of storing energy and recycling CO_2 in what may be termed a methanol economy.

Reversible fuel cells employing organic fuels are suited for stationary applications, because of the high specific energy of organic fuels (specific energy of methanol = 6232 Wh/kg) and as a stable liquid it is easier to store with existing infrastructure.

The technical challenge is one of efficiency, particularly how to separate CO_2 from other gases efficiently.

Biomass and Biofuels

Biomass is the organic matter of biological sources, typically plants and organisms.

[33]http://www.ausindustry.gov.au/content/content.cfm?ObjectID=ACCA1CF7-5900-4367-AA43BE6D0323ECD6&L2Parent=0786C9BE-08B7-4973-93429A645AEEC8E4&L3Parent=61B11DDD-1A32-42EE-9827BD5C63DE326D

[34]http://hotrock.anu.edu.au/resource.htm

In the process of photosynthesis, growing plants capture solar energy and sequester carbon dioxide from the atmosphere to form carbohydrates which serve as an important source of useable energy. This energy can be released directly by combustion or transformed by biological fermentation processes into a range of higher energy density fuels, such as methane, methanol, ethanol, dimethyl esters or oils, including animal tallows, otherwise termed biofuels. The carbon dioxide released following combustion of these fuels can be recycled with the recreation of organic biomass in the photosynthesis process. In a full life cycle, biofuel can therefore deliver solar energy in storable form with near zero net carbon dioxide emissions.

Electricity from biomass energy is suited to communities in the wheatbelt

According to Verve Energy, in August 2006, a commercial scale plant of 5 MW producing 40 GWh would service 5,000 homes, cost about $5M and use 50,000 dry ton of biomass per annum. This would be sourced from about 20 million trees planted at the rate of 2600 oil mallee trees per hectare occupying 7,700 hectares or 77 sq km. With the SWIS servicing 838,997 customers over 322,000 sq km, such plants would be suited to servicing decentralised communities across the wheatbelt.

Anaerobic digestion by micro-organisms of waste biomass to produce methane (biogas) is now a mature process with many small installations across Australia having been established since the mid 1980s. Technological refinements are continuing particularly in the improved digestion of fatty residues.

Locally, the Water Corporation converts waste sewage biomass by anaerobic digestion to biogas using the Organic Resources Technology. The product is methane (which is about 50 to 60% of biogas) and is used to generate 6 GWh of power annually. Such processes draw from a continuous supply of feedstock in centralised waste streams and can deliver continuous energy while reducing negatively-valued waste.

Another mature technology undergoing refinement is the production of ethanol from a range of biomass sources. Current international research activity is targeting low-value renewable feedstocks for ethanol production. According to the IEA, ethanol produced from lignocellulose sources such as stalks, bagasse, straw and wood reduces the risk of food substitution anticipated in more conventional ethanol-from-grain scenarios by drawing from lower value agricultural and forestry waste streams. [35] The biotechnology and logistics for such a process remain at the early development phase.

The technology for transformation of lignocellulose to ethanol is at an early stage of development and could also be more actively pursued locally as suitable feedstock and research capability in biotechnology are available.

Ocean energy

With rising levels, temperature, acidity and rate of dynamic change of the oceans, the associated stored energy offers potential opportunities to access increasing reserves of renewable energy.

Wave power

With its 20,800 km western coastline the efficient transformation of wave energy offers a potentially limitless source of renewable energy in coastal Western Australia. In 2005 the London-listed public company, Renewable Energy Holdings Plc, commenced trialling of a wave power and desalination prototype known as the CETO wave energy generator off the Fremantle coast generating some 100 kW.

[35]International Energy Agency (2006) Energy Technology Perspectives 2006- Scenarios and Strategies to 2050, Chapter 3, p 141

20,800 km of coastline has the potential for a major source of wave energy for WA

Tidal power

Tidal power is generated by trapping water behind a barrage across the mouth of an estuary or artificial storage and using the head difference as the tide changes to produce energy. Tidal barges require turbines that can produce power efficiently at variable head levels. This is unlike conventional hydro, which is designed for a relatively fixed head, particularly in low head applications

Tidal energy has been previously considered in Western Australia at Derby. One proposed option of the Derby Tidal Project, the 5 MW and 4.35 Mm3 storage at Doctors Creek, resulted in an approximate cost of energy of $0.36/kWh for tidal energy, before the inclusion of capital cost grants or green energy benefits such as Renewable Energy Certificates (RECs).

Fusion

Fusion power offers the potential of an almost limitless source of energy for future generations but it also presents some formidable scientific and engineering challenges. It is called 'fusion' because it is based on fusing light nuclei such as hydrogen isotopes to release energy. The process is similar to that which powers the sun and other stars. Effective energy-producing fusions require that gas from a combination of isotopes of hydrogen - deuterium and tritium

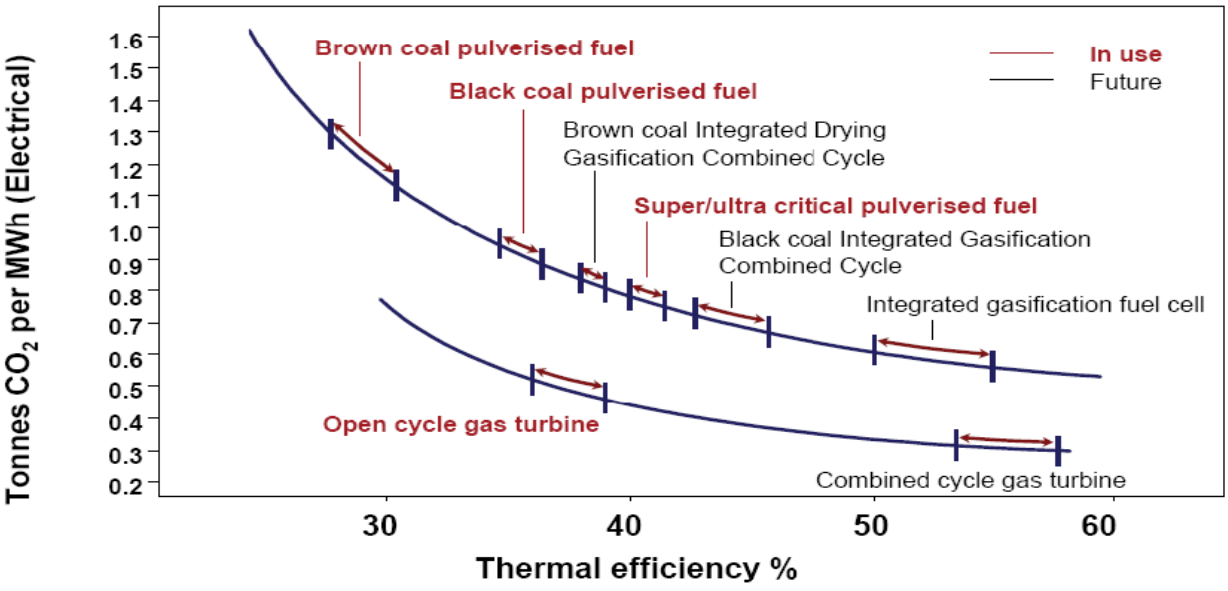


Figure 3.1 Summary of CO_2 emissions and thermal efficiencies for coal-fuel processes

Source: D Harris, CSIRO, September 2006

- is heated to very high temperatures (100 million degrees centigrade) and confined for at least one second.

Demonstration of the scientific and technological feasibility of fusion power is the objective of an international collaborative effort involving the European Union, USA, Japan, the Russian Federation, China, South Korea and India.

Fusion power creates no long-term radioactive waste and no climate changing or atmosphere polluting emissions.

3.2 Improving end-use energy efficiency

An assessment of potential energy demand end use reductions in Western Australia[36] through improved energy efficiency found that efficiency opportunities with private internal rates of return exceeding 15% (i.e. a six year payback period for the efficiency investment) could deliver major reductions in energy use and emissions over the period to 2030.

Introducing energy efficiency measures without factoring in any carbon price signal has the potential to reduce energy use below projected business-as-usual by between 12% (low scenario) and 28% (high scenario), with cumulative greenhouse emission reductions of 9.4 Mt to 21.6 Mt respectively by 2030 (Table 3.2). These scenarios would require average annual improvements in energy end use of 0.4% and 0.8% below business-as-usual, respectively.

Introducing additional measures that are made economic by factoring in a carbon price signal yields significantly greater emission reductions, in the range of 14.9 to 34.4 Mt by 2030 at a $40/t carbon price level (see Table 3.2).

In addition, these end-use energy savings are expected to deliver additional upstream emissions savings of between 15 to 20% (depending on the carbon price) through reduced transmission losses and reduced fugitive emissions from natural gas production.

However, market failures and barriers to energy efficiency tend to involve non-price factors, so complementary policy for energy efficiency is required even in the presence of significant carbon prices.

Table 3.2 Emissions projection and potential emission savings with a 6-year payback at various carbon prices (Mt CO_2e)

Carbon price $/t CO_2e	Scenario	2009-10	2014-15	2019-20	2024-25	2029-30
BAU Emissions (Mt CO_2e)		46.7	53.1	59.3	64.0	70.8
0	Low savings	0.6	2.0	4.0	6.4	9.4
	High savings	1.4	4.8	9.0	14.8	21.6
20	Low savings	0.8	2.7	5.3	8.5	12.4
	High savings	1.9	6.4	12.0	19.5	28.6
40	Low savings	1.0	3.3	6.4	10.2	14.9
	High savings	2.3	7.7	14.5	23.6	34.4

Source: Insight Economics (2006) Energy Efficiency: Policy Measures to Reduce Greenhouse Gas Emissions. Prepared for the WA Greenhouse and Energy Taskforce.
Note: Combustion only emissions factors

[36]Insight Economics (2006) Energy Efficiency: Policy Measures to Reduce Greenhouse Gas Emissions

As with the supply side, major energy-use infrastructure has a productive life of several decades. Early action to improve efficiency, even through small improvements beyond business-as-usual, can deliver significant cumulative reductions in energy end use emissions if sustained over time.

At constant real energy prices, uptake of cost-effective savings on energy efficiency will expand economic activity. This will induce the 'rebound effect' where the increased income from savings on energy efficiency is spent elsewhere in the economy, resulting in increased economic activity and greenhouse gas emissions.

Rebound effects are likely to be attenuated by price increases as carbon costs are factored into energy prices

Most studies in the Australian context suggest that the rebound effect reduces savings from energy efficiency investments at current prices by around 20%. On the other hand, rising domestic energy costs (such as might arise from increasing global fuel prices or from a domestic carbon price signal) will attenuate the rebound effect.

Achieving cost-effective energy efficiency in a modern economy requires a portfolio of measures, the prime focus of which should be on non-price barriers and market failures.

However, a fully effective portfolio would also improve relative pricing. This is particularly important for efficient outcomes over the longer term.

Key initiatives for energy pricing include:

- Congestion pricing to reduce peaks and avoid energy infrastructure overcapitalisation. This would involve installation of smart meters in new buildings (residential and commercial), combined with support for meter replacement programs for prioritised customer classes;
- Network pricing to ensure that all options to deliver energy services are considered and costed. This would involve, for instance, tests for network augmentation vs. alternative means of delivering the same level of energy services, and the capacity for the costs of all options, including non-network costs and 'foregone revenues', to be included in energy service costs; and
- Greenhouse gas emission pricing, which would incorporate the currently externalised costs of carbon dioxide emissions in energy prices to reflect the full cost of effective abatement through energy efficiency and other measures. This would also help to reduce the 'rebound effect'.

Although cost is not the only barrier to increasing energy end use efficiency, it is important to get pricing signals right

Providing public information about energy savings options and demonstrating these can be effective complements to improved pricing signals and programs targeting behavioural change.

Increased public awareness will enhance the capacity to make good decisions

Increasing public understanding of the importance of best energy technologies and practices and the benefits they could gain from energy savings is an important step towards broad community adoption of energy efficient equipment and technologies.

Supporting and extending energy rating and labelling through the current National

Framework for Energy Efficiency work program provides a means for community members to translate their interest in energy efficiency into effective decisions.

Minimum Energy Performance Standards (MEPS) provide extremely cost-effective means to improve energy efficiency and achieve win-win solutions for the consumer, the economy and the environment. Extending MEPS for the commercial and residential sectors would ensure that all consumers contribute to reducing the social cost of energy use and emissions. Over time MEPS would need to be regularly reviewed and amended to reflect technological improvements and the expected carbon price trajectory.

Minimum standards achieve win-win solutions for the consumer, the economy and the environment

While energy pricing, public awareness and minimum standards provide an essential base for reducing greenhouse gas emissions, significant reductions will require a major policy. This policy will need to include mandatory requirements and incentives to adopt energy efficiency beyond minimum standards.

Policies will be needed to progress beyond minimum energy efficiency standards

The Environmental Protection Act licence condition process could provide a mechanism for applying mandatory requirements to new energy intensive projects for energy savings measures that exceed a minimum internal rate of return set at a rate that will deliver 'no regrets' savings for the community as a whole. Other means of applying such requirements should be investigated and where appropriate applied.

As a complementary measure, incentives for energy efficiency could be introduced through a new 'Energy Savings Fund' similar to the one used successfully in NSW and similar to the successful water rebates schemes here in WA. It would:

- Identify key energy savings opportunities across the WA economy, particularly in priority sectors such as mining, with pilot programs to confirm savings potential and deliver subsequent program delivery;
- Fund, following competitive tender, cost-effective energy saving projects that exceed the minimum standards and mandatory requirements referred to above;
- Fund an energy efficiency awareness program targeting the commercial, residential and small business sectors;
- Support third party energy efficiency auditing for small business and residential consumers, combined with incentives, rebates and other promotions;
- Encourage increased use of performance contracting for the commercial sector;
- Fund targeted programs to improve energy efficiency for low income households; and
- Evaluate the performance of energy saving projects and the barriers to their implementation to provide feedback on the barriers to energy efficiency.

Cogeneration

In a conventional electricity plant, 50 to 70% of primary energy is lost in the form of waste heat. Cogeneration captures and uses this heat. Due to its greater thermal efficiency (Table 3.3), cogeneration reduces greenhouse gas emissions compared to the situation where equivalent quantities of heat and electricity are produced separately.

Table 3.3 The impact on greenhouse gas emissions and thermal efficiency of various cogeneration options

Generation type	Thermal efficiency (%)	CO_2 emissions (t/MWh)*
Renewables cogeneration	60–85	nil
Gas cogeneration	77	0.26
Combined cycle gas	48	0.39
Thermal gas	38	0.49
Thermal black coal	35	0.93

* reflecting combined output, i.e. heat and electricity
Source: Australian Cogeneration Association (1999)

These figures reveal significant differences in greenhouse impact. For instance, electricity produced from gas cogeneration has only two-thirds of the greenhouse impact of combined cycle gas generation and just over half compared with thermal gas generation.

Distributed generation

Generating electricity at the point of use rather than centrally is termed 'distributed generation'. It can offer the potential for reduced emissions if the distributed generation is done by low emission sources. It can also offer energy efficiency by avoiding line losses from transmission and distribution.

Currently, distributed generation is not cost effective compared to central generation. However, the development of some of the above technologies on a small scale offers the prospect of distributed generation making a contribution to emissions reduction.

Existing and rapidly emerging energy supply technologies could contribute to significant emission reductions

RECOMMENDATION 3

The Taskforce recommends that, to harness cost-effective efficiency opportunities and reduce energy waste, the WA Government:

i. Improve pricing signals in energy markets through carbon pricing, use of smart metering, tests for network augmentation, and allowing network service providers to recover foregone revenue from demand side investments;

ii. Support and extend energy rating and labelling;

iii. Seek to implement world class minimum energy performance standards for appliances, homes, office buildings and industrial equipment, extend their coverage, factor in a carbon price and regularly review standards to keep pace with technology development;

iv. Establish a mandatory energy efficiency program for large to medium energy users, initially to ensure that efficiency opportunities that offer no regrets greenhouse savings to the community as a whole are implemented; and

v. Establish an Energy Savings Fund, based on the NSW model of a small surchargeon energy consumption, to identify and invest in energy savings, home energy retrofitting, awareness raising, incentives, rebates and energy auditing for small and medium enterprises.

3.3 Technologies for cleaner energy supply

Emission reductions are already available from the broader application of existing price competitive, lower emission technologies such as combined cycle gas turbine electricity generation or advanced coal technologies. In addition, an intense and accelerating global research, development and demonstration effort is producing further low emission technologies which could yield significant abatement potential at low cost. Table 3.4 summarises the status, costs, emission intensity and abatement potential of the following electricity generation technologies in WA, using current prices for gas and coal:

- Combined cycle gas turbine (CCGT);
- CCGT with carbon capture and storage (CCGT-CCS);
- Advanced coal combustion;
- Advanced coal combustion with CCS;
- Integrated gasification with combined cycle coal (IGCC);
- IGCC with CCS;
- Biomass (dedicated crops);
- Wind;
- Wave, tidal and ocean;
- Geothermal (hot rock);
- Solar thermal; and
- Solar photovoltaic (PV).

Advanced renewable energy technologies including geothermal and wave power appear to be prospective sources of large-scale dispatchable power supply and significant greenhouse emissions abatement over the long-term. Should carbon capture and storage prove practicable in WA, advanced coal generation with geo-sequestration would significantly reduce future carbon emissions.

Applying low emission technologies in new stationary energy facilities and replacing existing higher emission plant with lower emitting alternatives has the potential to reduce WA's emissions significantly, with one estimate of as much as 50% below business-as-usual by 2030 (Table 3.5). On this basis, the emissions reduction potential could range up to:

- 19.2 Mt at less than $5/t (24% emission reduction);
- 34.4 Mt at less than $20/t (43% emission reduction); and
- 40.2 Mt at less than $40/t (51% emission reduction) [37].

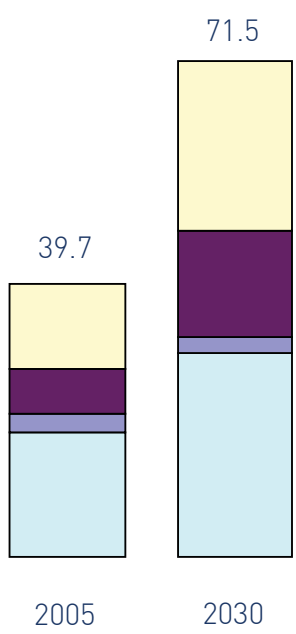
[37]Next Energy was commissioned to undertake an assessment of alternative technologies and development support mechanisms to identify supply side options for WA stationary energy. The data presented in this chapter is largely drawn from Next Energy (2006) Supply side options for WA stationary energy – An assessment of alternative technologies and development support mechanisms.

Table 3.4 Status, costs and emission intensity of electricity generation technologies in WA

Technology	Commercial availability	Emissions intensity t CO_2e/MWh	Costs $/MWh	Risks and uncertainties	Potential
Combined cycle gas turbine (CCGT)	Mature and widely available	0.38-0.42	$43	Gas price uncertainty	Large, but limited by access to domestic gas supply
CCGT with carbon capture and storage (CCGT-CCS)	CCS under development	0.06-0.04	$63	Suitable geological repository Timing of availability	Large, but limited by access to gas supply and geological storage
Advanced coal combustion	Under development	0.8-0.7	$39	--	Large
Advanced coal combustion with CCS	Under development	0.12-0.07	$56-$69	Suitable geological repository Timing of availability	Large, but limited by access to geological storage
Integrated gasification with combined cycle coal (IGCC)	IGCC under development	0.7-0.6	$40	--	Large
IGCC-CCS	IGCC and CCS under development	0.12-0.07	$52-$64	Suitable geological repository Timing of availability	Large, but limited by access to geological storage
Biomass (dedicated crops)	Relatively mature but not widespread	~0	$96	Impact on future agricultural activity	Large, but limited by availability of agricultural land
Wind	Mature	~0	$75-$90	Intermittency issues above 20% of network	Large, but broad scale application limited by intermittency
Wave, tidal and ocean	Under development	~0	$70-$120	Technical risks with harsh environment	Large
Geothermal (hot rock)	Under development	~0	$50-$70	Resources yet to be determined	Perth Basin is estimated to have 49,000 PJ of energy (more than 100 years of WA energy use)
Solar thermal	Under development	~0	$53-$100	Output varies with sun	An area less than 300 sq km could supply all of WA energy needs
Solar photovoltaic (PV)	Mature, but R&D continuing	~0	$320	Output varies with sun	An area of less than 300 sq km could supply all of WA energy needs

Source: Next Energy (2006) Supply side options for WA stationary energy – An assessment of alternative technologies and development support mechanisms

Table 3.5 Summary of greenhouse gas abatement potential through technology change by 2030

WA stationary energy emissions in 2005 and 2030 on current trends (Mt)	Potential stationary energy technology changes by 2030	Abatement (Mt)	Cost ($/t)
	**Gas**		
	Replace LNG OCGT with CCGT	0.3	‹$5
	Alumina upgrades – planned	2.6	‹$5
	Alumina upgrades – prospective	0.7	‹$5
	LNG high efficiency drives	2.5	‹$5
	Manufacturing upgrades	1.3	‹$5
	Petroleum		
	Biodiesel	2.9	‹$100
	Mining		
	Electricity		
	Replace OCGT with CCGT	1.4	‹$5
	Replace new CCGT with geothermal or wave	9.4	‹$5
		10.6	‹$20
	Replace new coal with advanced coal and CCS (or geothermal/wind/ solar thermal)	4.6	‹$20
	Replace coal refurbishment with geothermal/wind/ solar thermal	0.9	‹$50
	Retire coal early and replace with geothermal or wind	4.9	‹$50
	Retire CCGT early and replace with geothermal/wind/ solar thermal (or advanced coal and CCS)		
	Total Abatement	19.2	‹$5
		34.4	‹$20
		40.2	‹$50

Source: Next Energy (2006) Supply side options for WA stationary energy – An assessment of alternative technologies and development support mechanisms

The technologies changes and their associated costs outlined in Table 3.4 are directly relevant to the State's circumstances, consistent with current trends and based on what the Taskforce believes are 'reasonable' rather than revolutionary or unduly conservative assumptions. However, a number of factors could limit the potential abatement proposed in the table:

- Anticipated technology developments may not be realised;
- Lack of deterrent policies now may lead to investment in high emission long-lived technologies which suppress the future uptake of emerging low emission technologies;
- Gas prices may increase significantly relative to coal prices (Table 3.4 assumes gas prices are less than $3.50/GJ);

- Economic development may be higher or lower than projected; and
- CCS may turn out to be more expensive than or not as practical as currently believed, in particular, if storage sites are at a distant from the source.

Fostering the development and use of emerging low emission technologies and factoring in likely future carbon constraints would allow WA to minimise its exposure to future carbon liabilities, while continuing to provide low cost energy to power the resources and mining sectors that currently underpin the WA economy.

Figure 3.2 indicates a potential for a convergence of technologies which would deliver energy at a cost of about $40 to $50/MWh and an emissions intensity of 0.2 t CO_2e/MWh or lower by 2020 (see shaded area in Figure 3.2). The relative costs and emissions associated with on-ground realisation of these technologies at a future time will depend upon the costs of underlying inputs such as fossil fuels. For instance, an increase in fossil fuel price or a lower price for renewable technology options would support an earlier and wider uptake of renewable technologies which are currently not price competitive. Similarly, implementing a government policy that created an environmental and economic level playing

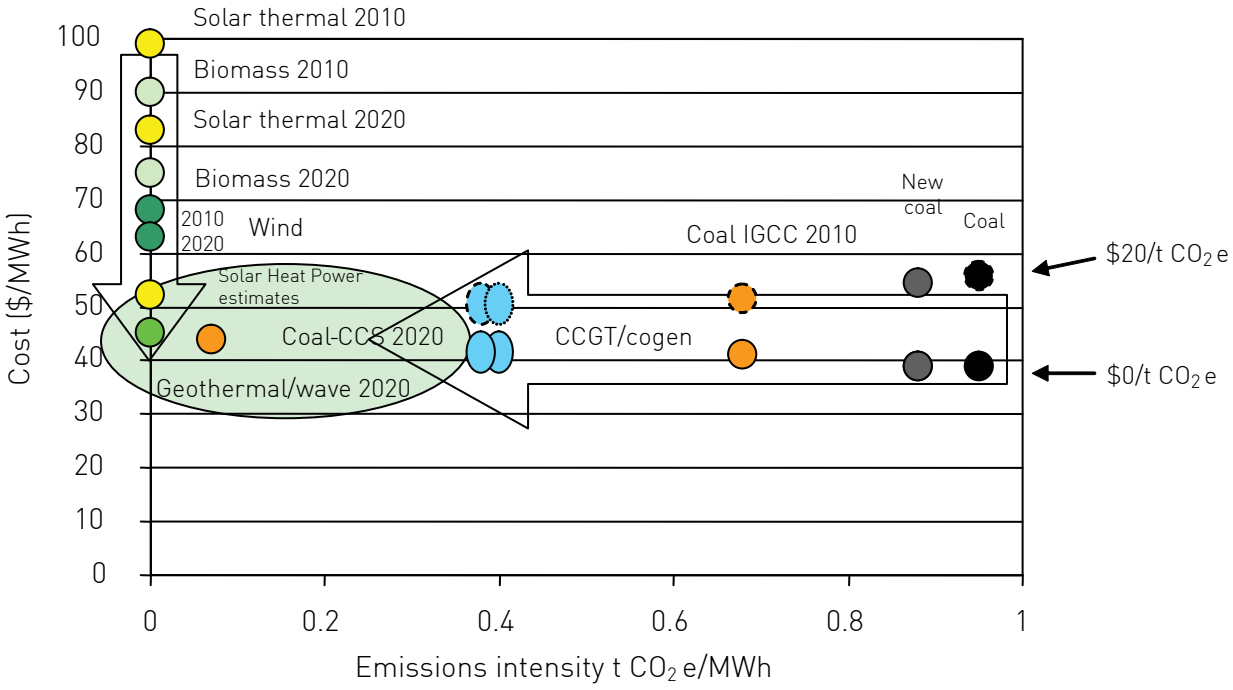


Figure 3.2 Overview of costs and emission intensity of electricity generation technologies in WA

Source: Source: Next Energy (2006) Supply side options for WA stationary energy – An assessment of alternative technologies and development support mechanisms

field through introducing a carbon price that addressed the externalities of greenhouse gas emissions would tend to promote an earlier uptake of lower or zero emission technologies.

Because there will be a relatively small number of major stationary projects that will in large part define the State's near-future energy profile, relatively small changes in government policy can have significant impacts. Moreover, where such policies are mutually interactive, they can achieve an even greater impact.

Government policy should focus where the greatest outcomes can be achieved

With intense global investment in rapidly emerging low emission technologies (both renewable and fossil fuel), it would be prudent to restrict new long-lived stationary energy generation investment to lower emission options as soon as practicable.

This policy direction is congruent with that applied by governments around the world, which are increasingly directing new investment to lower emission technologies. For instance, the NSW Government rejected the Redbank II power station proposal on the basis of unacceptable greenhouse gas emissions. In WA, the EPA assessment process is one possible mechanism for implementing this policy direction.

New investment in stationary energy generation should be directed to lower emission technologies

There are several key policy mechanisms available to avoid the establishment of further high emitting stationary energy supply plants:

- State a clear policy intent regarding long-term emission reduction targets for the stationary energy sector;
- Require all new plants to have the capacity to be retrofitted with existing or emerging 'bolt on' emission reduction technologies such as CCS; and
- Encompass all parts of the sector within the policy elements, including industrial cogeneration plants.

In considering emissions constraints on new generation, the Taskforce took the view that:

- Given recent increases in gas prices and the likelihood that gas will be significantly more expensive than coal into the future and in the absence of a carbon price, coal would be likely to win the major proportion of new power generation requirements;
- This outcome is likely to run contrary to the objective of positioning the State to achieve major emission reductions at the lowest long-term cost;
- One mechanism to influence this outcome would be for major new generation to be required to meet defined emission standards;
- In the short-term, until technological advances allow for 'clean coal' to meet such a limit, new coal generation would need to use offsets;
- Requiring use of offsets for new coal generation could increase generation costs in the order of 20%; and
- Under current market conditions there is a high risk that this will set the market price. Mechanisms would be required to ensure that prices received by existing generators, which would not be subject to the emissions constraint, do not also increase.

The preferred long-term approach to influencing the choice of generation technology is a national emissions trading scheme, which would result in an efficient and market-driven solution. For this and other reasons, national emission trading is strongly supported by the Taskforce.

In the interim, however, before national emissions trading is adopted, the small number of new power stations which will be required in WA should be treated on a case by case basis, taking account of the need to achieve longer-term emission reductions at acceptable cost. Mechanisms which spread the cost of any emissions constraint over all customers are recommended.

The Taskforce considered various options for a defined emissions intensity requirement to manage emissions but concluded that the costs and complexity of such a mechanism would not be justified for the likely short-term transitional period.

The Taskforce was of the view that, when considering new generation facilities on a case by case basis, the following factors should be taken into account by the WA Government:

- The long-term emission reduction objective for the sector should be broadly in line with current international consensus towards an emission reduction of 50% below 1990 levels by 2050;
- The emission intensity of the best currently available technology for base load electricity generation (high efficiency combined cycle gas turbine) is about 0.42t CO_2e/MWh; and
- The broader economic impacts, including the need to ensure that trade-exposed, energy intensive industries are not competitively disadvantaged.

Natural gas will play an important role in delivering emission reductions in the short to medium term and low emission outcomes in the medium to longer terms. WA should ensure it will have an adequate and economic gas supply by continuing to set aside gas resources for domestic purposes as natural gas fields are developed and continuing to facilitate the development of the required pipeline infrastructure.

Natural gas is a key element for future low emission energy supplies

There is an opportunity to avoid large fugitive emissions by ensuring that future LNG projects are required to pursue geo-sequestration. There is a significant cost associated with this course of action and technical challenges remain. It is also clear that some competing countries are unlikely to pursue this costly course of action. The Taskforce believes that it would be inconsistent with the other initiatives recommended if the development of high CO_2 natural gas fields for LNG were to go ahead without requiring carbon capture and storage.

Decisions regarding fugitive emissions from future LNG projects will have major impact

Considerable public and private investment is being directed to emission reduction technologies such as CCS. It will be important to understand the potential to apply these technologies in WA and to facilitate their widespread deployment. The WA Government, working with industry, has a key role in developing and facilitating the adoption of emission reduction technologies that are relevant to WA circumstances. Examples of technologies likely to be important for WA include geothermal, wave and wind power and CCS. The WA Government could promote the adoption of these technologies by identifying potential sites and resources, facilitating research and other means.

Promote early adoption of low emission and emission reduction technologies

As well as responding to the greenhouse gas issues, investment in these technologies would also provide opportunities to develop new industries for domestic and international markets.

It is also important to build capacity in government and industry to enable opportunities to be identified and potential barriers to be overcome. Key barriers currently

RECOMMENDATION 4

The Taskforce recommends that in order to discourage new investment in high emission technologies, the WA Government undertake the following steps:

i. Make a clear statement of policy intent that, WA will need to move towards a less carbon intensive economy;

ii. Require significant new generators to minimise emissions in line with contemporary emission intensity benchmarks, taking steps to limit any adverse impact of resulting electricity price rises;

iii. Require all high CO_2 content natural gas fields to use capture and storage technology for fugitive emissions; and

iv. Facilitate an adequate and economic gas supply through a domestic gas reservation policy and the development of adequate pipeline capacity.

relate to the use of intermittent power generation in the South West Interconnected System (SWIS), cogeneration and renewable energy options.

Mandatory emission reduction requirements or carbon price signals will be needed to ensure that emerging low emission technologies will be adopted at a significant scale. International, national and subnational markets for emission reduction credits and offsets already exist where mandatory requirements have been established or where emitters voluntarily have adopted emission limits.

WA should prepare for future carbon pricing

All credible energy sector operators have been aware of the nature of the emerging international greenhouse gas emissions limitation regime as far back as 1997 when the Kyoto Protocol was agreed. All Australian mandatory and voluntary programs have been developed using Kyoto Protocol frameworks and rules.

The Government should ensure that energy sector operators and project proponents recognise that they will be liable for future carbon price and emission reduction costs in the same way that they will benefit from future carbon emission reduction credits they generate through achieving emission levels below the levels established for their plant or sector.

Government can help limit the future greenhouse emission liability faced by WA operators by clarifying its policy regarding emission targets and liability for emission reductions under mandatory emission limits.

RECOMMENDATION 5

The Taskforce recommends that, in order to prepare WA for future carbon pricing, the WA Government:

i. Make a clear statement that, as a general principle, all new stationary energy developments will be liable for the full cost of future greenhouse gas emission compliance; and

ii. Foreshadow a future carbon price, develop a carbon risk analysis framework and consider imposing a requirement for project proponents to undertake a carbon price sensitivity analysis.

3.4 Research and development opportunities

Western Australia's direct public investment in energy-related research currently averages at about $5 million annually and together with indirect investment, historically represents about 10% of total state investment in research. Publicly supported research capability covers a broad range of expertise from organic renewables to deep sea natural gas recovery, but is generally sub-critical on an internationally competitive scale, growing at about five new researchers per year.

The State's public investment in technological innovation has generally been driven by clear policy positions focusing on investment in common-user science infrastructure since 1990. Flowing from this, it is now apparent that, subject to the availability of relevant infrastructure, critically-scaled research activity in targeted areas relevant to the private sector is occurring as and when required. However, longer-term strategic research initiatives remain the province of government and are subject to sustained and patient investment over the long-term.

WA needs a major new focus on the development of greenhouse gas reduction technologies

In considering the national landscape, the most significant Commonwealth investments in recent explorative research through the Australian Research Council were in solar photovoltaics, followed by intelligent transport systems, hydrogen and fuel cells. At the less speculative technology deployment level, Commonwealth forecasts for near-term energy technology demonstration appear to highlight 'energy efficiency' followed by geo-sequestration and brown coal as the most prominent areas for future investment. Notably absent in Commonwealth forecasts is any significant support for low-emission demonstration initiatives in wind, geothermal, wave and fuel cells which have considerable relevance to Western Australia, particularly as the State offers more diverse geographical characteristics which favour a diversity of technological solutions.

Historically, however, Western Australia has a generally poor record of winning its share of Commonwealth investment in research and development and must support its own needs in this context whilst endeavouring to overcome any competitive disadvantage in winning Commonwealth funds.

Nonetheless, Western Australia's industry has demonstrated a ready willingness to invest in low-emission technology processes in recent years. Such initiatives include Western Power's wind farms; Verve Energy/CSIRO's biofuel gasification pilot; Renewable Energy Holding's wave energy pilot; Cool Energy Ltd's trial of cryogenic CO_2 separation; Organic Resources Technology Ltd's biofuel from sewage facility; and Gorgon's geo-sequestration plans.

From a policy perspective, Western Australia's low-emission technology needs stem from a short-term focus on improved efficiency and longer-term focus on competitive advantage. In partnership with industry and academe, the State can invest significantly in relevant research and deployment initiatives related to these needs, safe in the knowledge that accelerated technological innovation is an internationally accepted way of tackling climate change, while at the same time positioning for economic opportunity. In such a future environment, the opportunity is available to add value to the State's resources in an energy-constrained world. For example, research into nanotechnology applicable to the efficient separation of gases and conversion of methane from natural gas into higher value applications. Not to align with this approach would

[38] Stern, N (2006) The Economics of Climate Change: The Stern Review, UK Cabinet Office: HM Treasury.

disadvantage the future economic development of the State relative to its trading partners. In this context, the recent Stern Review[38] advocates a doubling of research funding and a five-fold increase in incentives for technology deployment, a position which would appear well within the State's capacity to adopt.

RECOMMENDATION 6

The Taskforce recommends that, in order to facilitate longer term technology development, the WA Government:

i. Establish a dedicated and technically competent Greenhouse Technologies Development Unit to plan, coordinate and implement an Energy Technology Innovation Strategy;

ii. Assign the Greenhouse Technologies Development Unit, as a first task, to scope and plan the science infrastructure needs, including human resources, relevant to the development of world class research activity in emission reduction technologies in partnership with industry and academe;

iii. Establish a low emission technology development fund, to leverage significant Commonwealth and other public and private research and development expenditure to position WA industry to prosper in this field of economic opportunity, and to support research and development identified as high priority for WA.

iv. Provide incentives to attract cutting edge projects and develop skills, critical mass and intellectual property in emerging low emission technologies which have particular relevance to the State's needs and competitive advantage;

v. Work with industry to undertake a detailed feasibility study for carbon capture networks in industrial regions;

vi. Undertake a detailed identification and assessment of potential sites for geo-sequestration of CO_2, geothermal, wind, wave and tidal energy development and review any barriers to deployment of these technologies;

vii. Establish policy measures to secure strategic geo-sequestration sites; and

viii. Encourage proponents of new energy intensive projects to provide financial contributions to the low emission technology fund.

3.5 Renewable energy

In addition to the policies set out above, the Taskforce considers the development of renewable energy to be an integral part of securing a low carbon future. WA could actively promote renewable energy supplies, both to contribute to emissions reductions and importantly, also to harness the potential industry development opportunities where these align with WA's competitive advantage.

Indeed, governments around the world are providing increasing support for renewable energy technologies, with many countries, states and regions setting renewable energy targets. These include:

- A UK target of 10.4% by 2010;
- An EU Directive to increase from 14% in 1997 to 22.1% in 2010;
- China's commitment to a 10% increase by 2010 and 15% by 2020 (excluding traditional biomass and large scale hydropower); and

– India's commitment to a 10% increase by 2012.

In Germany, a feed-in tariff that guarantees a premium for renewable energy that is fed into the electricity grid has delivered significant increases in renewable energy capacity, new jobs, diversified energy supply and better energy security.

In Australia, the Mandatory Renewable Energy Target (MRET), targets a 9500 GWh increase in the contribution of renewable energy sources by 2010. The introduction of this target led to $3 billion investment in renewable generation, but the industry has since stalled with the Commonwealth Government announcing its intention not to extend the target.

The Victorian Government has recently announced the Victorian Renewable Energy Target (VRET), a mandatory scheme to increase the share of renewable energy sources to 10% by 2016. According to the Victorian Government, this has already resulted in the investment in what is expected to be the largest solar energy power plant in the world and a significant wind power project[39].

In South Australia, a recently announced feed-in tariff provides a premium tariff for any PV power fed into the grid, so any home owner or investor can be guaranteed to receive a premium for the solar electricity, thus reducing the pay back period for the initial investment.

At the time of writing this report, Parliament was considering a Private Member's Bill for a WA Renewable Energy Target.

RECOMMENDATION 7

The Taskforce recommends that the WA Government take significant additional steps to promote the development and expansion of renewable and very low emission energy, including:

i. Setting a mandatory renewable energy target for the SWIS through to 2020 of the order of 15 to 20%, recognising the desirability of keeping costs consistent with the carbon price trajectory set out in Recommendation 11;

ii. Measures to provide further support for renewable and very low emission energy technologies, including geothermal, solar and wave technologies, which have significant potential for WA in the future, but that are not yet sufficiently developed to compete with established technologies (such as wind). Consideration should be given to:

- Sub-targets for particular technologies set within the overall target;
- Premium tariffs or subsidies per unit of energy supplied; and
- Capital grants or concessional finance;

[39] Solar Systems media, release 25 October 2006, World-leading Mega Scale Solar Power Station for Victoria http://www.solarsystems.com.au/154MWVictorianProject.html

iii. Implementing a project facilitation service to assist projects to access finance, locate suitable sites and deal with planning, approval and grid connection processes and barriers; and

iv. Calling for expressions of interest to establish a pilot geothermal (hot dry rock) energy project in WA.

3.6 Emerging options to capture and store combustion emissions

Carbon capture and storage (CCS) is emerging as a viable option for reducing emissions from fossil fuel power plants.

Carbon capture and storage is the subject of intense research and development but views about when it will be technically and commercially viable range from 10 to 30 years.

Although it is expected to cost more, using carbon capture and storage is likely to decrease the emissions intensity of coal and gas plants by up to 85% [40].

Carbon capture and storage is emerging as a viable option for reducing combustion emissions, although it has not yet been commercially deployed

Because the atmosphere is mostly nitrogen, the concentration of CO_2 in the exhaust gases from power plants is relatively low. To achieve reasonable costs for carbon transport and storage infrastructure, it would be necessary to concentrate the CO_2 to a nearly pure stream. This process of CO_2 separation and concentration is well demonstrated in industrial plants.

Transport and storage of the captured CO_2 would further add to costs, depending on the availability and location of a suitable storage site.

The availability of a suitable geologic reservoir is essential to carbon capture and storage. The GEODISC program screened about 300 prospective sites in Australia, many of which were found to be potentially suitable. The Cooperative Research Centre for Greenhouse Gas Technologies is currently investigating a smaller number of these in more detail, including the Perth Basin, for potential pilot projects.

Ideally, these areas have rocks such as permeable sandstone that are overlain by a seal of non-permeable rocks. Assuming favourable geologic conditions are found within

The Perth Basin is being investigated for its potential for a pilot carbon storage project

[40] Next Energy, (2006). Supply side options for WA stationary energy – An assessment of alternative technologies and development support mechanisms. Report prepared for the WA Greenhouse and Energy Taskforce.

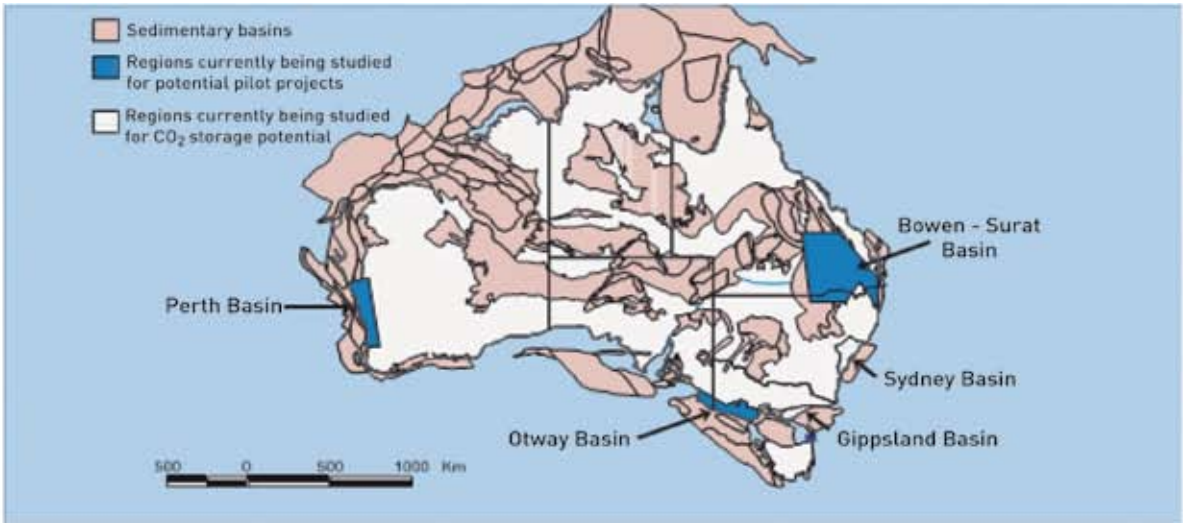


Figure 3.3 Regions currently being studied for potential pilot projects or likely CO_2 storage potential

the Perth Basin, geo-sequestration of power plants in the SWIS may be feasible.

The use of carbon capture and storage is estimated to increase the costs of power generation from CCGT plants by 40 to 60% and the cost from coal plants by 50 to 80% [41]. However, due to the relatively low emissions intensity of the CCGT, the average cost of abatement would be relatively high for CCS used with CCGT compared to coal.

Carbon capture and storage will add about 50% to the costs of power generated from fossil fuels

Without a price on carbon or an emissions intensity requirement for a new plant, CCS is unlikely to be used to any great extent.

Emerging technology may deliver significant cost reductions in the medium term. For example, the technology roadmap and program plan of the US Department of Energy's carbon sequestration program[42] has targets of significant cost reductions from current levels. In particular, the overarching program goal by 2012 is to demonstrate 90% CO_2 capture, 99% storage permanence and a cost increase of less than 10%.

Emerging technologies are likely to deliver cost reductions over the medium term, although a carbon price is needed for widespread use

The CRC for Coal in Sustainable Development holds a more conservative view[43] regarding the prospects for CCS for supercritical plant, anticipating a capital cost premium for post combustion capture of about 70% by 2015, with no expected cost reductions from implementation experience. In its review of emerging technology studies for advanced coal combustion, the IPCC[44] found estimated increases in average energy cost relative to

[41] Next Energy, (2006). Supply side options for WA stationary energy – An assessment of alternative technologies and development support mechanisms. Report prepared for the WA Greenhouse and Energy Taskforce.

[42] US Department of Energy Carbon Sequestration Technology Roadmap and Program Plan 2005 in Next Energy Report.

[43] CCSD (2006) Appendix A" in Next Energy Report.

[44] Intergovernmental Panel on Climate Change (2005) Special Report on Carbon Dioxide Capture and Storage in Next Energy Report.

typical technology of about 60%.

Extensive development work is ongoing for post-combustion capture, which would be suitable either to new or retrofit CCGT applications, as well as to coal power plants. Also under development and of relevance only to new special purpose CCGTs is the use of oxygen, rather than air, in the combustion process. Oxyfuel combustion would involve developing new turbines as well as low cost processes for producing oxygen.

Opportunities to retrofit existing plants are more limited and less cost effective. Emerging technology studies reviewed by the IPCC found that retrofitting of post-combustion systems would increase average energy cost by over 100%. This suggests that any consideration of new coal combustion power plants for development prior to the commercial availability of carbon capture should be designed to facilitate subsequent retrofitting with post-combustion carbon capture.

Retrofitting is expensive, so it is important to lock in low emissions when power plants are built

RECOMMENDATION 8

To strategically prepare for a carbon constrained world, the Taskforce recommends that the WA Government:

i. Fast-track work to identify suitable geo-sequestration sites in WA;

ii. Facilitate a pilot geo-sequestration project in the Perth Basin; and

iii. Require all major new fossil fuel plant to plan for future carbon capture retrofits as carbon capture and storage (CCS) technology becomes available.

3.7 Government leadership in emissions reduction

The Western Australian Greenhouse Strategy, released in 2004, aims to reduce greenhouse gas emissions and take advantage of the opportunities generated by action on climate change. Many of the actions in the Strategy are relevant to the deliberations and influence the effective implementation of the recommendations of this Taskforce.

The WA Government has an opportunity to lead by example in reducing its emissions

Two actions from the Strategy that are integral to the implementation of the Taskforce's recommendations are the creation of the WA Greenhouse Gas Inventory, with major emitters required to report emissions annually and to develop reduction strategies, and the WA Greenhouse Registry to document and certify carbon credits from emission reduction and offset activities.

Other actions that have been considered by the Taskforce in their deliberations have been outlined briefly in Section 1.5: 'The WA approach to date'. However, the recommendation below includes the continuation and/or extension of several existing programs which the Taskforce

considers are good models of government leading by example.

Through the Greenhouse Strategy, the Government has a commitment to purchasing the equivalent of 5% of its electricity from cost-effective renewable sources by 2006-07. The Strategy also requires the development of a comprehensive Renewable Energy Strategy with initiatives aimed at supporting and developing renewable energy in Western Australia over the medium to long term, including a renewable energy target for 2020.

The 'Energy Smart Government' policy requires all general government sector agencies with 25 or more staff (FTEs) to reduce annual energy consumption from 2001-02 levels by 12% by 2006-07. Agencies are also required to report their total energy costs, consumption, greenhouse gas emissions and key performance indicator data each year.

The purpose of the policy is to realise ongoing absolute reductions in energy use, energy costs and associated greenhouse gas emissions by establishing energy efficiency as an integral component in the management of government assets. The Energy Smart Government policy covers all stationary energy used in buildings, plant and equipment by participating State public sector agencies.

Similar to the Energy Savings Fund proposed in Section 3.2, Facilitation Grants are available to enable identification of energy saving opportunities, implement systems to increase accuracy of energy data and undertake small capital projects or demonstration projects. Capital Advances are available to assist with implementation of energy saving capital projects, with the maximum allowable payback period recently increased from five to seven years.

Since the program's inception in June 2002, the Government has saved $7.7 million in agency operating costs and avoided the emission of nearly 40,000 tonnes of greenhouse gas. The program's overall target of a 12% reduction in energy use was achieved by 48% of agencies two years ahead of schedule, and 20% of agencies reduced energy use by more than 20%.

The Solar Schools program is designed to support the installation of solar (photovoltaic or PV) power systems on 100 metropolitan and regional state government schools. The program has the following objectives:

- Enable students to learn about sustainable energy;
- Raise community awareness of sustainable energy;
- Lead to the long-term reduction of greenhouse gas emissions; and
- Increase the uptake of renewable energy in rural and remote areas.

The Sustainable Energy Development Office (SEDO) estimates that each of the 1 kW solar systems save an average of 2 tonnes of CO_2 per year and around $1760 in expenses. However, if schools implement efficiency measures in conjunction with the systems to reduce energy use by 10%, the cost savings can increase to around $11,500 per year. There are currently 1074 primary and secondary schools in WA that could be fitted with solar systems which would result in savings of around 35,000 tonnes of CO_2 each year for the next 20 years. More importantly, these provide an opportunity for students and the surrounding community to learn more about renewable energy, energy efficiency and be more aware of their energy use in general.

The State Government won the Australasian Fleet Managers Association's National Environment Award for 2006 in part due to the introduction of a emissions offset scheme for the 63,000 tonnes of CO_2e emissions from the Government's passenger and light commercial

vehicle fleet.

This program includes an agreement with Men of the Trees' Carbon Neutral Program to plant over 100,000 oil mallee trees as part of a landcare program to help with salinity and wind erosion problems as well as several revegetation projects which are seeing ecosystems and habitats regenerated to address salinity and waterlogging issues and reducing farm fertiliser runoff which causes nutrient enrichment problems in lakes.

Developing partnerships with local government should be a particular focus for the State Government in order to implement many of the Taskforce's recommendations including energy performance standards for the residential sector, energy efficiency audits and community awareness programs.

In WA, 34 local government councils currently participate in the Cities for Climate Protection Program which assists councils to make an initial emissions inventory, set reduction goals, plan and implement actions and then monitor progress under a strategic milestone framework. Leading councils then move on to the CCP Plus Initiative where reduction goals and greenhouse gas reductions strategies are strengthened and accelerated.

RECOMMENDATION 9

The Taskforce recommends that the WA Government lead by example by:

i. Buying or leasing, and operating, minimum 5-star buildings or tenancies (subject to availability), buying the most efficient appliances in range, and ensuring all computer and office equipment is Energy Star compliant and enabled;

ii. Purchasing a greater proportion of Green Power for Government electricity use, establishing new energy efficiency targets for government agencies and extending its Carbon Neutral and Solar Schools programs;

iii. Establishing a program to progressively install cogeneration in government-owned hospitals and other appropriate institutions wherever possible; and

iv. Continue working closely with and assisting local government in their greenhouse gas abatement initiatives and programs.

3.8 Feasibility of achieving a 50% emission reduction target

Figure 3.4 summarises the foregoing estimates of potential emission reductions from energy efficiency and technology improvement, at a carbon price up to $25/t CO_2e, depicted as a series of wedges extending out to 2030.[45]

These potential emission reductions depend on effective technological development and implementation, particularly in relation to energy efficiency, carbon capture and storage (CCS), and commercially viable sources of renewable energy. It is emphasised that achieving these savings will require immediate, strong and ongoing commitment to the policies and programs which the Taskforce has identified. It is also noted that the estimates are predicated to a large extent on effective action by the rest of the global community — to provide for a price for carbon and to drive technological change.

Immediate action could put Western Australia on a pathway to deep cuts by 2050

While acknowledging the significant risks and uncertainties surrounding these caveats, the Taskforce has concluded that there is potential to return greenhouse gas emissions to current levels by around 2030. This provides a pathway towards deeper emissions cuts by 2050. However, it is clear that meeting a 50% reduction in emissions on 1990 levels by 2050 would require substantial new breakthroughs in energy technology.

In such a timeframe, substantive technological breakthroughs are possible, particularly if driven by significant carbon prices and effective support for research and development

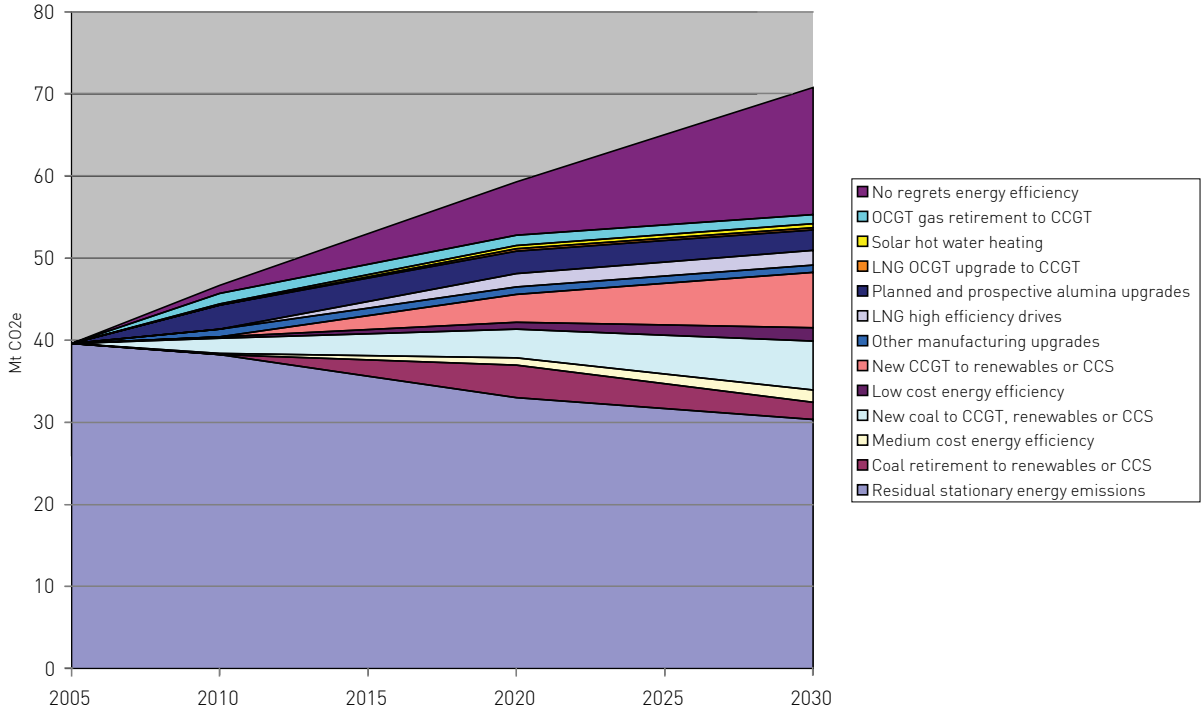


Figure 3.4 Indicative greenhouse gas abatement 'wedges' from technology and energy efficiency at a carbon price of $25/t

[45]The ordering of the wedges accounts for respective relative marginal costs. Each wedge's abatement quantity is reduced sequentially in proportion to the cumulative emissions reductions achieved by implementation of the prior lower cost wedges.

4 Targets and market mechanisms

4.1 Setting targets to drive action

The extent of climate change will depend on the total amount of greenhouse gases in the global atmosphere. Acceptable risk as now understood by scientists and policy makers will require deep global cuts in net emissions. Cuts from 1990 emission levels of the order of 50% or more by 2050 and up to 80% by the end of the century will be necessary to limit global mean temperature increases to 2°C or less. A formula to share the necessary cuts and the resulting costs equitably between nations has not been agreed, although the Kyoto Protocol represents an important first step.

Targets and timetables provide a clear signal and goal to measure progress and inspire action

In 2004, the then Australian Chief Scientist, Dr Robin Batterham, advised Australian Governments that he believed it was technically feasible and necessary for Australia to reduce greenhouse emissions by 50% by 2050 and 80% by 2100.

Other nations and states are already introducing targets to match this current thinking.

The UK Royal Commission on Environmental Pollution in 2000[46] recommended that a developed country such as the UK would need to reduce emissions by 60% from 1990 levels by 2050 and 80% by 2100. EU Environment Ministers[47] proposed that developed countries make plans for reducing emissions by 15 to 30% by 2020 and by 60 to 80% by 2050 from benchmark levels in 1990. Table 4.1 lists some of the targets adopted by other nations and states.

Table 4.1 Current international targets and timetables for reducing greenhouse emissions

Jurisdictions	Existing targets
UK	60% by 2050
Netherlands	30% by 2020 and 80% by 2050
France	75% by 2050
Germany	40% by 2020
Sweden	60% by 2050
California	80% by 2050
NSW and SA	60% by 2050

Target setting enables a clear acknowledgement of the order of magnitude of the task ahead, a degree of certainty for business investment, a yardstick for all policy development and a measure against which governments can be held accountable.

Target setting is a key element of any policy reform process

The Business Council of Australia supports 'clear long-term emissions targets in line with global responses' and the Australian Business Roundtable on Climate Change has called for 'a long term aspirational goal for Australia to significantly reduce greenhouse gas emissions as our contribution to a global effort designed to avert dangerous climate impacts'[48].

There is a range of low emission technologies either already available or rapidly emerging. If current technological trends continue and further innovation eventuates over coming decades, it is highly conceivable that costs of the necessary emission reductions over time could be affordable.

[46]Energy: The Changing Climate http://www.rcep.org.uk/news/00-2.htm

[47]Wijkman, A. (2005) Winning the Battle Against Global Climate Change. Adopted by the European Parliament on 16 November 2005.

[48]Australian Business Roundtable on Climate Change (2006) The Business Case for Early Action, p7 www.businessroundtable.com.au

There are major economic opportunities for Western Australia in the explosively growing international market for such technologies. For example in Germany, renewable energy policies have lead to the creation of 157,000 jobs in the renewable energy sector and a 5% increase in exports in 2005 in that sector. [49]

Despite the hurdles which will need to be overcome domestically and internationally in order to achieve a reduction of 50% by 2050, the Taskforce considers that the WA Government should establish this as an indicative target.

This would:

- Be in line with estimates of emission reductions required to have a reasonable chance of limiting increases in global mean temperatures to 2°C;
- Be of the same order as targets adopted by NSW and SA;
- Be similar to the targets adopted by many European countries and US states; and
- Give a clear signal to investors, industry and government agencies of the magnitude of the task over the long term.

The target should be subject to periodic review because:

- There is still considerable scientific uncertainty, international and national political uncertainty and economic uncertainty, especially over such a long timeframe; and
- The cost of reaching such a target is highly uncertain: there is some risk that the cost may be unacceptably high.

The Taskforce suggests that targets based on the best currently available knowledge and in expectation of global action provide a useful basis to guide government policy development and infrastructure investment.

RECOMMENDATION 10

The Taskforce recommends that the WA Government adopt an indicative target to reduce greenhouse gas emissions to a level of 50% below 1990 levels by 2050.

The Taskforce considers that a target for 2050 does not give a sufficient signal to government, industry and investors about the level of effort that is required in the near term. Most economic modelling shows that the cost of reaching any long term target is much lower if serious action to reach the targets begins earlier rather than later. The Tyndall Institute[50] in the UK has recently pointed out the critical importance of effective early action in reaching long-term targets. It also makes a case for why greater emission reductions are required, calling on the UK Government to adopt a target of 90% reduction below 1990 levels by 2050 and providing a detailed analysis of how such a target could be met. The Stern Report[51] was even more emphatic about the need for early action to reduce emissions.

The Taskforce considers it highly unlikely that WA could achieve a 50% cut by 2050 without serious, probably unacceptable, economic damage if current international and national policy settings remain unchanged. Policies are needed now that will put Western Australia on a path to achieving cuts sustainably over time. This will reduce inequitable economic consequences for later generations.

Accordingly, the Taskforce recommends that the Government articulate a clear requirement for greenhouse gas abatement for the WA economy over the medium term.

The simplest and most obvious approach would be to set quantity targets for emissions, for

[49] Engineers Australia 'Ensuring the energy supply' Cameron, D Vol 78 No 9 p 39, September 2006

[50] Tyndall Centre for Climate Research (2006) *Living within a carbon budget*, Report for Friends of the Earth and the Co-operative Bank.

[51] Stern, N (2006) The economics of Climate Change: The Stern Review, UK Cabinet Office: HM Treasury.

example, stabilisation on 2006 emission levels by 2020. However, the Taskforce considers that:

- It is uncertain whether a significant proportion of other countries would also make cuts of an equivalent scale by 2020;
- The global effect of WA cutting its own emissions by any particular amount by 2020 would be insignificant; and
- On the other hand, small, globally insignificant differences in total WA emissions at any particular date could cause very significant and inequitable differences in costs to Western Australia's citizens and businesses.

The Taskforce therefore believes that it is more important to apply gradually strengthening policy and economic drivers to reduce emissions but to keep the costs (rather than total emissions) within targeted limits in the medium term.

The Taskforce's preferred means to this end is for the WA Government to establish a price trajectory for the cost of carbon through time — and to use this to put an explicit ceiling on the marginal costs of abatement from policies for greenhouse action in Western Australia.

This carbon price target trajectory does not imply a preference for carbon taxes. Rather, the carbon price 'cap' would be an explicit consideration in the design of the State's portfolio of greenhouse policies and the assessment of national and international policy proposals including emissions trading.

The price trajectory would aim to position the economy for deeper cuts later, while maintaining economic growth. The price trajectory would reduce uncertainty for investors in longer lived assets, give impetus to cost-effective actions that can be undertaken now, provide incentives for innovation and adoption of new technologies (e.g. energy efficiency measures) and encourage early progress towards the longer term 2050 target. The price trajectory would also allow for greenhouse gas abatement 'quantity discovery' — which is currently uncertain — thereby providing an indicative emissions reduction profile and informing required future action on greenhouse.

Importantly, the price trajectory would also constrain the cost of unilateral greenhouse gas abatement actions for Western Australia. This would help to cap the economic costs of action to affordable levels over the medium term, further increasing certainty for investors in the Western Australian economy.

RECOMMENDATION 11

The Taskforce recommends that, to provide direction for policy development and private investment in the short term, the WA Government:

i. Develop an estimate of the future risk weighted carbon price trajectory;

ii. Base policy for achieving substantial emissions abatement by 2020 on this estimated carbon price trajectory;

iii. Determine indicative emission reduction profiles based on the carbon price trajectory; and

iv. Establish legislative triggers for progressive policy intervention every three to four years to strengthen policies if current measures fail to deliver the desired emission reductions toward the 2020 and 2050 objectives.

4.2 Providing a carbon price signal through national emissions trading

Market-based instruments can be a preferred means to address environmental externalities such as greenhouse, by providing a price signal that 'internalises' the cost of environmental impacts in decision making. In this way, the market mechanisms can be harnessed to deliver greenhouse gas emissions reductions.

The World Economic Forum G8 Climate Change Roundtable last year stated that:

Policy frameworks that use market-based mechanisms to set clear, transparent and consistent price signals over the long term offer the best hope for unleashing needed innovation and competition[52].

It called on Governments to:

Establish a long term, market-based policy framework extending to 2030 that will give investors in climate change mitigation confidence in the long term value of their investments. Establishing indicative signals extending to 2050 would also be beneficial[53].

Exactly what market-based instruments constitute the best approach for greenhouse is open to debate. Pervasive uncertainty surrounding the degree and impacts of climate change presents challenges for designing an optimal economic policy. This uncertainty relates not just to what degree of global abatement is prudent over what timeframe, but also to what the economic costs of achieving that abatement might be.

Emissions trading is one market-based instrument widely regarded as an effective and efficient means of achieving economy-wide or global emissions reductions at least cost over the long term. Emissions trading equalises the marginal cost of abatement among participants, which is a key requirement for economic efficiency.

Emissions trading is included as a key 'flexibility mechanism' in the Kyoto Protocol and has been (or will be) adopted by the European Union and a number of sub-regions in the United States. In Australia, NSW has an established emissions trading scheme to constrain greenhouse emissions from the electricity generation sector (the Greenhouse Gas Abatement Scheme).

The recent Stern Review undertook a comprehensive evaluation of the costs of climate change, finding that the benefits of early action far outweigh the economic costs of not acting. The Review concluded that emissions trading should be a key element of a future international framework to address climate change.[54]

Expanding and linking the growing number of emissions trading schemes around the world is a powerful way to promote cost-effective reductions in emissions and to bring forward action in developing countries: strong targets in rich countries could drive flows amounting to tens of billions of dollars each year to support the transition to low-carbon development paths.

Worldwide, the value of trading is growing exponentially. In 2005, it was worth about $15 billion (up eight-fold on the previous year).

The Commonwealth Government considered introducing a national emissions trading

[52] Statement of G8 Climate Change Roundtable convened by the World Economic Forum in Collaboration with Her Majesty's Government, United Kingdom 9 June 2005, p 2: Http://Www.Weforum.Org/Pdf/G8_Climatechange.Pdf

[53] Ibid.

[54] Stern, N (2006), The Economics of Climate Change: The Stern Review, UK Cabinet Office: HM Treasury, ppvi. Western Australian Greenhouse Strategy(2004) p 43. Prepared by the Western Australian Greenhouse Task Force.

scheme a few years ago. It favours international emissions trading, provided that it includes all major global emitters.

In anticipation of a national approach, the States and Territories have been designing and evaluating a model for a national emissions trading scheme (NETS). The Commonwealth has recently announced its own emissions trading taskforce, without the involvement of other jurisdictions.

The WA Greenhouse Strategy states that 'If there is no action at the national level to establish a framework to achieve lowest cost emissions abatement through market mechanisms prior to the first commitment period of the Kyoto Protocol, the WA Government will consider implementing a state framework or consider joining with other States in a multi-state abatement scheme'. [55]

The recent National Emissions Trading Taskforce Discussion Paper outlined details of a proposed emissions trading framework.[56] Stated aims of the Taskforce include reducing greenhouse gas emissions and improving certainty, particularly for investors in long-lived capital in energy markets. The key features of a NETS as proposed in the discussion paper are listed in Table 4.2

[55]Western Australian Greenhouse Strategy(2004) p 43. Prepared by the Western Australian Greenhouse Task Force.

[56]National Emissions Trading Taskforce (2006) Possible Design for a National Greenhouse Gas Emissions Trading Scheme, www.emissionstrading.net.au .

Table 4.2 Key features of the national emissions trading scheme (NETS) proposed by Australian States and Territories

Element	Detail
Scheme design	National cap and trade scheme commencing in 2010 (at the earliest)
Coverage	Stationary energy sector initially — emissions from: - Electricity generators greater than 30 MW from 2010; - Other sources of stationary energy with emissions greater than 25,000 tonnes CO_2e per year from 2015; and - All six greenhouse gases
Scheme cap	Firm annual caps for the first 10 years 'Gateways' for the second 10 years through upper and lower bounds
Banking and borrowing	Unrestricted banking of permits No borrowing of permits prior to their 'date stamp'
Penalty	Civil penalty set at a level to cap the cost of the scheme but also encourage compliance
Offsets	Offsets to be eligible — priorities identified as forestry, carbon capture and storage, reductions in industrial process emissions and methane destruction Rules for creation of offsets consistent with emerging approaches for the Joint Implementation mechanism under the Kyoto Protocol Credits created under the Clean Development Mechanism of the Kyoto Protocol (excluding temporary credits) to be eligible as offsets credits under the NETS
Permit allocation	Permits allocated through: - free grants to existing generators to compensate adverse impacts on profitability; - free grants to existing and new trade-exposed energy-intensive industry to offset energy price rises; and - remaining permits to be auctioned, with revenue distributed to States and Territories to fund support for other adversely affected groups

The Taskforce considers that the broad direction of the NETS proposal is appropriate and should be endorsed as a way forward to provide a broadly based domestic carbon signal.

Many of the features of the proposed NETS are beneficial from Western Australia's perspective:

- The phased approach ensures that a carbon signal is provided for electricity generation from the outset, while allowing time for fine-tuning of arrangements for extension to other sectors of the economy;
- Free permit allocation provides a potential means to address equity issues for adversely affected entities such as energy intensive, trade exposed industry and existing generators;
- Auctioning of residual permits after free allocation provides a funding source;
- Banking provisions increase flexibility and help to smooth the price path, and
- Inclusion of offsets allows low cost options from elsewhere in the economy to contribute to abatement.

A number of preferred features of a NETS may be more difficult to implement without the participation of the Commonwealth Government. For this reason, every effort should be made to bring the Commonwealth Government into the development process.

RECOMMENDATION 12

The Taskforce recommends that, in order to prepare WA for future carbon pricing, the WA Government:

i. Endorse national emissions trading as a preferred domestic transition to a carbon constrained world;

ii. Continue to work with the National Emissions Trading Taskforce towards a national scheme involving the Commonwealth, the States and Territories;

iii. Support implementation of the National Emission Trading Scheme based on:

- a phased approach to sectoral coverage commencing with the electricity generation sector;
- assistance for adversely affected firms through the allocation of permits;
- assistance for trade-exposed energy intensive industry to account for the impacts of the scheme on individual projects; and
- inclusion of offsets.

Nevertheless, implementing emissions trading in advance of global action on climate change presents challenges for maintaining the competitiveness of trade-exposed energy-intensive industries. There is a threat of leakage of economic activity to other countries that do not have an emissions constraint. This could reduce the nation's welfare, but may not result in a net reduction in global emissions. This issue is a particular concern for Western Australia which has a significantly higher export profile and greater energy intensity than the rest of Australia.

Lack of adequate assistance for trade-exposed industry may disadvantage Western Australia. The Taskforces believes that the competitive circumstances of specific industries and the differential impacts of the NETS on existing and new projects will need to be taken carefully into account in the design of the assistance mechanisms.

Investor certainty is likely to be enhanced through a clear indication of the price of carbon going forward. As noted in the preceding section, a preferred way to increase certainty is by establishing an appropriate trajectory for the price of carbon. The best means to do this with the NETS would be to set the cost of the penalty for non-compliance on a trajectory equivalent to the expected risk-weighted global price of carbon.

The Taskforce considers that while there is considerable uncertainty about the future price of carbon, at this point it is reasonable to expect that future mitigation efforts will focus on stabilising global greenhouse gas concentrations at somewhere in the range between 450 and 550 ppm CO_2e by 2100. On this basis, the Taskforce believes a reasonable expectation is for global carbon prices to be approaching at least $25 per tonne of CO_2e (real 2005 Australian dollars) by 2020. Given uncertainty about the exact course of future action, this could provide a reasonable end point for a penalty cap for the NETS for the decade 2010 to 2020. The penalty for non-compliance after this time could be established during the review of the NETS (slated to occur in 2015) or could be superseded if Australia joined a new global system.

If a trajectory for the NETS penalty is established consistent with this end point, then the NETS quantity cap could be set consistent with more optimistic expectations of what quantities of abatement will be achieved at the specified penalty level. This would provide maximum encouragement for innovation, while improving understanding of abatement potential within Australia. It would maximise

the benefits of 'positioning' for a future carbon constrained world, in terms of providing a clear price signal for long lived assets. The penalty cap would ensure that economic costs of transitioning to the expected international price for carbon are minimised.

It will be important that the design of the NETS is as consistent as possible with emerging international regimes for trade in emissions abatement, including measurement, monitoring and verification approaches. This will be crucial to reduce the risks that abatement, undertaken in advance of a global regime, will not be recognised in the future. Linking to other international schemes should be a priority as one way to reduce this future risk. Linking to the Clean Development Mechanism of the Kyoto Protocol also helps to mitigate this risk, while providing a further cap on the cost of compliance for investors.

A carbon price signal will encourage investment in cost-effective actions to reduce emissions. However, it needs to be part of a broader portfolio of policy. Other policy instruments could be chosen as either:

- Transitional to an emissions trading scheme; or
- Complementary to an eventual emissions trading scheme.

It is the Taskforce's view that emissions trading must be truly national to be effective. There is a danger that the implementation of the NETS could be delayed if the States and Territories are unable to reach agreement. However, delay that resulted in emissions-intense new electricity generation would impose future costs on the economy in a carbon constrained future.

A range of complementary measures should be adopted that will enhance the action of carbon pricing mechanisms to maximise emissions reductions and reduce the total cost. In particular, there is a need to address the non-price market failures that prevent an efficient transition to a carbon constrained future. As noted by the World Economic Forum G8 Climate Change Roundtable last year:

Properly designed emissions trading programs can and will induce companies to reduce their emissions of greenhouse gases. However, the primary effect of such mechanisms is to promote efficiencies in energy use or manufacturing processes; they are less likely to stimulate major technological change or breakthroughs. Therefore, a continuing emphasis on other public and private sector programs to stimulate the development and commercialisation of new low carbon technologies is required. Technology-specific government support is essential for basic research that offers long-term prospect of success but remains too risky to attract private sector investment. This is especially relevant in areas where technological breakthroughs have not yet been achieved [57].

A price signal alone will also not provide sufficient support for energy efficiency. Extensive data from many countries and sources, including the National Framework for Energy Efficiency, shows that there is persistent market failure in relation to energy efficiency for a wide range of reasons and, that considerable efficiencies are available at low and even negative cost. Measures to support development of offsets and public understanding and support are also necessary.

[57]Statement of G8 Climate Change Roundtable convened by the World Economic Forum in Collaboration with Her Majesty's Government, United Kingdon 9 June 2005, p3: Http://www.Weforum.org/Pdf/G8_Climatechange.Pdf

Key complementary policies include measures for:

- Energy efficiency - as outlined earlier in the report; and
- Technology development through RD&C.

4.3 Providing flexibility through the use of offsets

The term 'offset' is used to describe a greenhouse gas reduction or removal from a discrete activity that is then used to counterbalance or 'offset' emissions elsewhere in the economy. Offsets are typically used by companies subject to a cap on emissions to meet an emission target.

Offsets can provide flexibility to meet mandatory emmission reduction requirements

Offsets are generated from an emission reduction or removal project. Possible examples of offset projects are:

- planting trees;
- changing land use to less emission intensive uses;
- changing agricultural practices;
- capturing and storing greenhouse gas emissions; and
- modifying industrial processes to reduce greenhouse gas emissions.

The Taskforce has primarily considered the use of offsets in the stationary energy sector in relation to flexibility for:

- New electricity generation projects where emissions are in excess of any Government-applied limit (for example, the level of emissions of the best currently available base load technology CCGT, which is currently 0.42 t CO_2/MWh);
- Participants in an emissions trading scheme can use offsets to meet any shortfall in emission permits (see Section 4.2); and
- Voluntary purchase of offsets by individuals or companies to become 'carbon neutral'.

The Taskforce has considered the potential for offsets to be recognised as one way in which proponents can meet emission restrictions. Offsets are typically generated outside the organisational boundaries of companies subject to restrictions, allowing them flexibility to take the lowest-cost approach to achieve any particular emissions cap.

Specific rules will need to be developed to establish the rights and responsibilities associated with the creation and trading of offsets to ensure that offsets are credible and deliver real emission reductions.

Rules must be set to ensure that offsets are credible and deliver real reductions

One of the most challenging aspects of creating these rules is the question of how to assess emission reductions that go beyond business-as-usual activities. In order to quantify the offset, it is necessary to first establish a baseline of what would have happened in the absence of the offset project. The baseline should include all plausible responses and decisions by companies that would have occurred anyway, either in response to mandatory requirements or through voluntary action.

Many offset projects will face ongoing management issues and proponents will need to demonstrate that there is an appropriate risk management regime in place to ensure permanence of the offset and its ongoing integrity. It is also critical that offset project proponents be able to demonstrate that offsets can be accurately measured, monitored, reported and audited and that there is clear ownership of the offset itself.

It is clearly desirable for any WA offset rules to be as consistent as possible with other existing national and international programs to allow interaction between emerging schemes.

Compatibility with other emerging schemes will allow for future trading of offsets

In Australia, an offset certification program - Greenhouse Friendly - has been developed by the Commonwealth Government to allow the use of offsets for a greenhouse labelling scheme. NSW has its own credit regulations under the NSW Greenhouse Gas Abatement Scheme and the National Emissions Trading Taskforce is developing its own approach to the use of offsets.

Internationally, the flexibility mechanisms of the Kyoto Protocol include the opportunity to create offset credits through Joint implementation (JI) and the Clean Development Mechanism (CDM). If Australia were to ratify the Kyoto Protocol, offsets created in WA could be converted into credits under the Kyoto Protocol through the JI mechanism if the systems are compatible.

Ideally, a WA offset regime should apply internationally compatible rules that are consistent with national developments and require registration in appropriate and effective registries. This will help reduce transaction costs for participants and reduce the likelihood that incompatible frameworks will emerge in Australia.

A common mechanism to manage offsets is to develop a registry to provide official, consistent and credible quality assurance for generators, users, buyers and sellers of offsets. A registry will also record the initial quantity and ownership of an offset and subsequently track the holding, transfer, acquisition, surrender, cancellation or retirement.

A registry will provide quality assurance and facilitate voluntary activities

In addition to its role in underpinning any future mandatory requirements, a registry is also critical to facilitate voluntary action. Although Australia does not currently have a national registry, there is no reason that one could not be established.

Until such time as a national registry is in place, a WA registry could be developed to recognise early abatement activities and support trade in offsets. In addition, WA may wish to consider the use of additional offsets not recognised under the national registry, where they are generated within WA, comply with relevant CDM or JI rules and contribute to the State's sustainability.

The type of offsets (see Table 4.3) that should qualify for registration under the WA registry includes those created in forestry projects, land use changes and agriculture. It is possible that some of these WA-specific offsets would not be usable outside the State (especially offsets created from land use changes and agriculture), and would need to be registered in a WA registry and managed entirely within a WA State system on an ongoing basis.

The Taskforce recognises that for an offset to be credible it must be:

- Additional to any regulatory requirements and what might have otherwise occurred in response to mandatory requirements or through voluntary action;
- Secured on a permanent basis, with arrangements for risk management and ongoing integrity of the abatement;
- Quantifiable with consistent, robust and verifiable approaches that are internationally recognised; and
- Demonstrating clear legal ownership.

Table 4.3 Offset categories for consideration in a WA context

Offset	Overview
Forest sinks **(Article 3.3 of the Kyoto Protocol)**	Forest projects can provide a source of relatively low-cost abatement by reforestation of farmland. This can comprise commercial plantations and biodiversity plantings, as long as they meet the definition of a forest. Potential for over 2,200 Mt CO_2e of abatement has been identified from reforesting 16.8 Mha of agricultural land in WA. Rules governing forest projects are already in operation under the carbon sequestration framework of the NSW Greenhouse Gas Abatement Scheme. Key features of this framework include: - Forests must be on land that was cleared before 1990 and planted on or after that date; - Appropriate risk management procedures are in place regarding fire, disease, pests and climate variability; - The proponent must be capable of maintaining the sequestration for 100 years (permanence); - The offset must be calculated by using the Australian Standard for Carbon Accounting and be conservative; and - Proper insurance should be in place to provide equivalent sinks should the project not meet expectations.
Land use change **(Article 3.4 of the Kyoto Protocol)**	Other types of land use change projects include revegetation, grazing land management, cropland management and forest management practices. Estimates for revegetation (e.g. saltbush establishment) are not available for WA, whereas Australian research suggests that the amount of carbon that may be sequestered in soils via cropland management is likely to be small, this contrasting with overseas experience on more fertile soils. It is estimated that between 290 and 1,170 Mt CO_2e may be sequestered by changing grazing practice on 94.8 Mha of rangelands[58]. There may be significant issues in measuring this carbon and risks associated with long-term storage. All of these projects are also vulnerable to non-permanence or reversal events by either natural or anthropogenic disturbances.
Agriculture **(Article 3.1 of the Kyoto Protocol)**	In WA, agricultural emissions are the second biggest contributor to total emissions. In 2002, savannah burning accounted for 44% of agricultural emissions, livestock 34% and agricultural soils 21%. Offset projects could include agricultural management practices that increase the carbon stored in the soil or reduce emissions from livestock. For instance, changes to livestock management might include changes to feed, vaccinations that improve digestion and reduction in animal numbers, size and/or age. Agriculture projects are not eligible in the NSW, UK or EU emission trading schemes, but are included under the Greenhouse Friendly program. The WA Climate Change in Agriculture Working Group is assessing the potential to develop an emissions intensity benchmark for Australian agriculture.
Industrial process emissions	It is possible that industrial process emissions could be included in a future emissions trading scheme. However, as a transitional measure offsets could be created to encourage emissions reductions below the expected baseline until they are included in a broader scheme. These levels could be determined on an emission per output basis, with the baseline being determined using an average emission per unit of output over a defined baseline period.
Carbon capture and storage (CCS)	Capture of greenhouse gas emissions before they reach the atmosphere and the subsequent storage in geological formations represents a potential way to achieve significant reductions in the level of emissions within the stationary energy sector. Under the NETS it is proposed that carbon captured and stored in Australia via CCS should be treated as a sequestration activity that can create offsets, rather than a reduction in emissions, to more effectively ensure the integrity of the storage. However, successful development of CCS remains conditional on a number of factors, including: - Reducing the costs of applying the technology; - Ensuring that CCS is safe, secure and permanent; - Developing the necessary legal and regulatory frameworks; and - Gaining public acceptance of the technology.

[58]CRC for Greenhouse Accounting (2006) 'The potential of greenhouse sinks to underwrite improved land management' Journal of Ecological Engineering (in prep.)

Renewable energy and energy efficiency projects are sometimes proposed as potential offset projects. However, they both lead to double counting of emissions within a cap and trade system.

Not all activities are suitable for offset creation. Double counting should be avoided

For this reason, the National Emissions Trading Taskforce has proposed that project activities that displace grid-based generation in the closed system are not eligible to create offsets. Indeed, it is anticipated that these types of projects will be deployed as an abatement activity to comply with the emission targets under emissions trading, if they are cost effective compared to other potential alternatives.

Offsets are not unlimited and the Government must consider the implications for other sectors of the use of offsets. All sectors will nominally need to reduce emissions to similar levels.

Offsets can increase the economy wide costs of meeting target if measures are not put in place in all sectors

If, for example, agricultural offsets are eligible for offsetting stationary energy emissions, the agricultural sector will find options for meeting its own emission targets more limited. The use of offsets might, in fact, increase the overall costs of economy-wide emission reductions if measures are not put in place in other sectors, or appropriate adjustments made to targets set for stationary energy.

RECOMMENDATION 13

The Taskforce recommends that, in establishing a WA offset regime, the WA Government:

i. Promote the establishment of a national registry to govern offset creation, registration and trade and provide a set of common offset rules for all national programs;

ii. Seek compatibility with international rules for offsets;

iii. Establish a WA registry:

- to manage WA offsets as an interim measure before a national registry is in place; and
- to manage WA offsets that meet international requirements but are not recognised nationally;

iv. Establish a regulatory body to determine the parameters and establish procedures to ensure that offset standards are applied and that there is no double counting; and

v. Assess the WA potential for offset supply and facilitate their supply through government programs.

5 Economic analyses - impacts of action

The recent Stern Review[59] provided a wide ranging evaluation of the costs and benefits of taking action on climate change. It concluded strongly that the benefits of strong, early action on climate change far outweigh the costs. In summary, the Stern Review drew the following conclusions:

- The benefits of taking action are the avoided damages and other net costs of business-as-usual climate change. These are estimated to be equivalent to an average reduction in global per-capita consumption of between 5 and 20% below what would otherwise have been possible.
- Most of these risks can be removed through a strong mitigation policy which stabilises greenhouse gas concentrations in the atmosphere at or below 550 ppm CO2e. To achieve this, global emissions must stop growing sometime in the next two decades, and then fall at a rate of at least 1 to 3% per year. By 2050, global emissions will need to be around 25% below current levels.
- The best estimate of the costs of taking action to stabilise global emissions in the range of 500 to 550 ppm CO2e is found to be a reduction of 1% of the level of global GDP in 2050. This would equate to reducing global GDP growth from 2.5% per annum over the period to 2050 to 2.49% per annum. The 1 January 2050 level of global output would be delayed by four to five months.

Economic analyses suggest that the benefits of strong, early action on climate change outweigh the cost

The Stern Review based its central best estimate on a wide cross-section of modelling. It found that the likely range of economic impacts around the best estimate was +/- 3% by 2050.

The variation in the estimated economic costs of taking action can be explained by the underlying assumptions adopted in the various modelling exercises. Key elements that influence the economic costs of mitigating emissions include:

– The projected growth rate in the emissions baseline — this establishes the degree of abatement required to ensure stabilisation of gases at a particular concentration level, and is influenced in turn by assumptions about economic growth;

– Rates of technological change — new modelling incorporates faster rates of decarbonisation from induced technical change (due to greater investment in abatement R&D) and from learning by doing (recognising the effects of faster demand growth in driving down costs);

– Flexibility mechanisms — relates to assumptions about 'what' sectors, gases and technologies are covered, the location of 'where' abatement can be achieved across the globe, and 'when' or how soon abatement needs to occur in time to achieve a given stabilisation level; and

– Valuation or otherwise of co-benefits — mitigating greenhouse gas emissions can deliver additional benefits, such as improved air and water quality, reduced salinity and improved health and amenity.

In Australia, a range of recent economic studies have suggested that the costs involved in delivering substantial national abatement are modest:

– Macroeconomic modelling for the Australian Business Roundtable on Climate Change found that economic impact of achieving a reduction in Australia's emissions of 60%

[59] Stern, N (2006), The Economics of Climate Change: The Stern Review, UK Cabinet Office: HM Treasury,

of 2000 levels by 2050 would reduce the average annual rate of GDP growth from 2.2 to 2.1%[60]. Delaying action by nine years would lead to significantly greater economic costs at 2050 to achieve the same cumulative reductions in emissions, reducing the annual rate of GDP growth to 1.9%;

- ABARE found that the GDP costs for Australia of contributing to substantial global cuts in emissions of around 40% below the reference case would be between 2.6 and 3.4% of GDP in level terms at 2050[61]. Key assumptions included a 70% reduction in global trade barriers, leading to rapid growth in global emissions; and
- Economic modelling by Frontier Economics in collaboration with the World Wildlife Fund and AGL found that 30% reductions in emissions could be delivered by 2030 with a one-off investment equivalent to around $252 for every Australian[62].

Economic studies indicate that only modest costs are involved in achieving substantial reductions in Australia's emissions

More recently, the National Emissions Trading Taskforce undertook macroeconomic modelling of the impacts of their proposed National

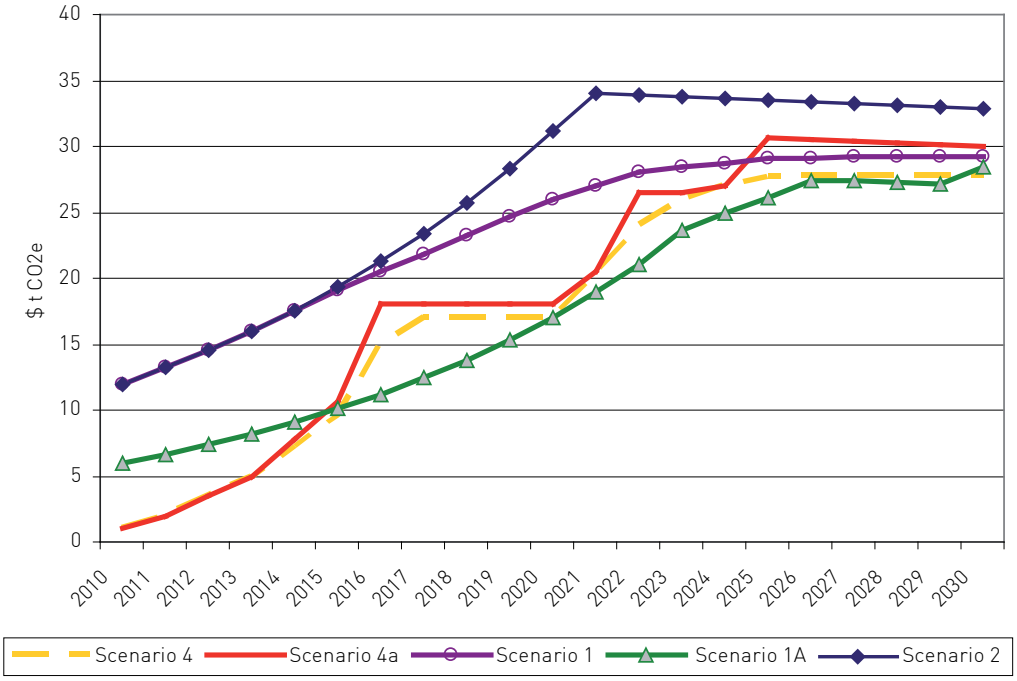


Figure 5.1 NETS carbon prices

[60] The Allen Consulting Group (2005), Deep Cuts in Greenhouse Gas Emissions, Report to the Business Leaders' Roundtable on Climate Change.

[61] Ahammad, H., Matysek, A., Fisher, B.S., Curtotti, R., Gurney, A., Jakeman G., Heyhoe, E. and Gunasekera, D. (2006), Economic Impact of Climate Change Policy: The Role of Technology and Economic Instruments, ABARE Research Report.

[62] AGL, Frontier Economics and WWF-Australia (2006), Options for moving towards a lower emission future, www.wwf.org.au .

Emissions Trading Scheme (NETS)[63]. A range of NETS scenarios were examined.

The key economic messages from these modelling scenarios (descriptions of scenarios are in Appendix 7) are:

- The carbon prices required to significantly reduce emissions from Australia's electricity generation sector are estimated to be in the range of $17 and $31 per tonne of CO2e (Figure 5.1), with the actual outcome dependent on the targeted reduction, the coverage of sectors and gases, and on assumptions about the timing, costs and availability of carbon capture and storage technologies, enhanced energy efficiency and forestry offsets;
- Private consumption impacts on Western Australia are close to zero for these scenarios (Figure 5.2);
- However, above carbon prices of around $25 per tonne of CO2e, the welfare costs of abatement start to rise quite sharply, for Australia and Western Australia;
- Relatively greater emissions reductions occur in States and Territories other than Western Australia at the scenario carbon prices, due to relatively greater quantities of lower cost abatement elsewhere than in Western Australia;
- Western Australia is one of the States least affected by domestic emissions trading. This result is driven in part by the large share of energy-intensive, trade-exposed industries in Western Australia, which are shielded from the effects of the NETS through the permit allocation process. This result reinforces the importance for Western Australia of getting the permit allocations right; and
- Recent trends to higher gas prices in Western Australia, if sustained, could see fuel switching away from gas and towards coal-fired electricity generation in Western Australia. This makes the task of achieving domestic abatement nationally more difficult. Despite this, the positive boost to welfare from the higher gas prices tends to outweigh the additional costs of meeting the domestic targets at lower carbon prices.

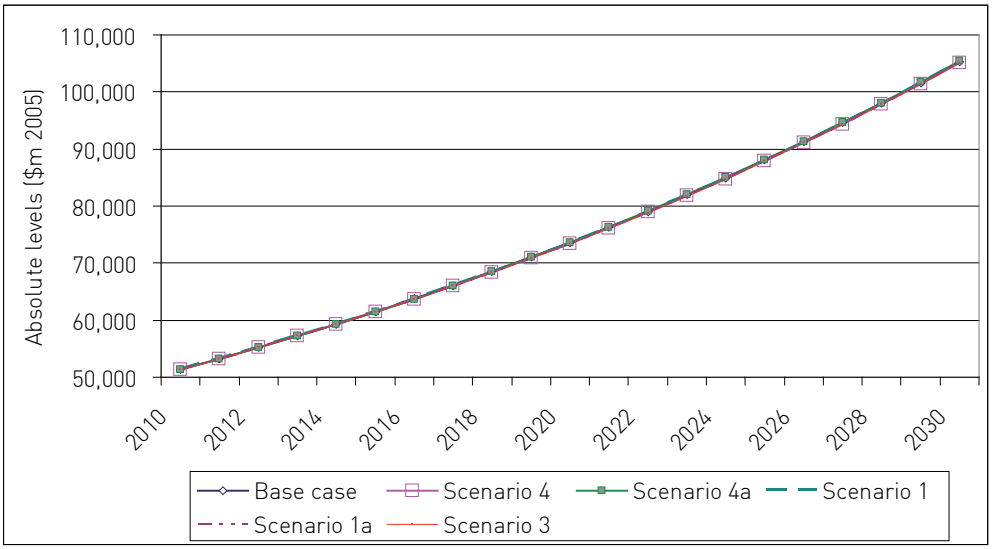


Figure 5.2 NETS – Private consumption levels in Western Australia

[63] The Allen Consulting Group (2006), The Economic Impacts of a National Emissions Trading Scheme: Final Report to the National Emissions Trading Taskforce, www.emissionstrading.net.au .

A further message from the modelling is that complementary policies to drive uptake of 'no regrets' energy efficiency can reduce substantially the costs of meeting a given target.

This occurs because the majority of energy efficiency opportunities are 'no regrets' investments yield internal rates of return exceeding 15% (see Section 3: Abatement potential). As a result, the economic benefits of effective policies to drive uptake of energy efficiency can outweigh the costs. Modelling for the Greenhouse and Energy Taskforce indicated that, by 2030, effective policies could:

- Boost Western Australia's GDP by 1.0% in level terms compared to the business as usual base case;
- Increase private consumption in Western Australia by 0.4%;
- Create an additional 4,690 jobs;
- Achieve an emissions reductions 'wedge' of 15.5 Mt CO2e by 2030, below business-as-usual; and
- Work to offset the costs of other policies aimed at reducing the emissions intensity of energy supply.

Overall, the economic costs of Western Australia participating in a national approach to greenhouse gas abatement are small, provided that the action includes:

- National emissions trading, with prices capped between $25 to $35 per tonne CO_2e through to 2030;
- Adequate compensation for trade-exposed industry, in advance of a fully global approach;
- Compensation to existing generators for the financial impact of introducing emissions trading;
- Inclusion of offsets; and
- Complementary policies to drive uptake of 'no regrets' and medium cost energy efficiency.

On the other hand, adoption of unilateral greenhouse gas abatement actions by Western Australia could lead to net economic costs. Unilateral actions considered by the Taskforce included:

- A Western Australian Renewable Energy Target — renewables tend to deliver higher cost emissions abatement, which can add to overall costs. Economic justification for such a target would therefore require offsetting co-benefits, such as from industry development, returns to local innovations or network augmentation savings; and
- A Western Australian Emissions Intensity Target, requiring lower emissions intensity levels for new electricity generation. Unless carbon prices jump substantially beyond those considered in the above analysis, such a target could have unacceptable costs, particularly in light of recent increases in gas prices.

Overall, the economic costs of unilateral actions on greenhouse are likely to be higher than those resulting from participation in a national scheme. Economic analysis is a key element informing further policy development. Care would therefore be needed in the design of any package of unilateral actions to limit the net costs of action to acceptable levels.

Development and evaluation of greenhouse policy should be informed by rigorous economic analysis.

Economic analysis is a key element in forming further policy development

As action at all levels accelerates and becomes more costly, much stronger capabilities within Government will be needed. Additional resources will need to be allocated to this as it will be integral to policy development in the future.

The unique nature of the WA economy requires

specific modelling and other economic analysis for this State.

There are particular areas that the WA Government should be focusing on now to inform decision making over the next few years.

RECOMMENDATION 14

The Taskforce recommends that the WA Government:

i. Strengthen its capacity for greenhouse policy related economic analysis, including consideration of a specialist area and additional on-going resources;

ii. Initiate additional economic analysis on the following initial priorities:

- the existing extent of subsidies that encourage higher emissions and the opportunities to eliminate or reduce perverse subsidies;
- analysis of the likely costs and benefits of key emerging technologies including, for example, CCS, geothermal and wave;
- underpinning modelling and data for drawing the proposed carbon price trajectory; and
- economic impacts on WA of market measures, particularly emission trading scheme design options.

6 Recommended action

Findings and recommendations against the Taskforce Terms of Reference

In responding to its Terms of Reference, the Taskforce has accepted the Intergovernmental Panel on Climate Change's evidence of climate change as providing the scientific basis for action.

Furthermore, the Taskforce recognises the global effort to reduce significantly global greenhouse gas emissions to a rate that will stabilise global atmospheric concentrations at a level that would avoid dangerous human interference with the climate system.

The Taskforce has concluded that global action to reduce greenhouse gas emissions is likely to continue and strengthen as the consequences of climate change become more evident and that Western Australia should play an appropriate part. However, the timing and the strength of a global framework are currently uncertain.

A. Practical and economically feasible policies to manage GHG emissions from the stationary energy sector in the short term

The Taskforce has identified a range of policies that it considers both practical and economically feasible that help WA manage its greenhouse gas (GHG) emissions from the stationary energy sector in the short term, while avoiding the risk of stranded assets and future liabilities for greenhouse gas emissions.

The Taskforce recommends that the WA Government set policy goals for action to reduce greenhouse gas emissions as follows (Recommendation 1):

i. To maximise the chances of success of international efforts to prevent dangerous and costly climate change;

ii. To reduce emissions in ways that avoid severe or seriously inequitable economic impacts on WA industry or the community and avoid stranded assets;

iii. To limit the expense to WA taxpayers to that which is reasonable, cost effective and equitable in the context of global initiatives; and

iv. To review progress regularly and incorporate additional measures as they become appropriate in the global context.

In developing policies and actions for the short term, WA must seek to avoid competitive disadvantage for its trade-exposed sectors that might compete with industry based in countries that have not established equivalent emission constraints.

The Taskforce recommends that in order to discourage new investment in high emission technologies, the WA Government undertake the following steps (Recommendation 4):

i. Make a clear statement of policy intent that WA will need to move towards a less carbon intensive economy;

ii. Require significant new generators to minimise emissions in line with contemporary emission intensity benchmarks, taking steps to limit any adverse impact of resulting electricity price rises;

iii. Require all high CO_2 content natural gas fields to use capture and storage technology for fugitive emissions; and

iv. Facilitate adequate and economic gas supply through a domestic gas reservation policy and the development of adequate pipeline capacity.

The Taskforce recommends that the WA Government take significant additional steps to promote the development and expansion of renewable and very low emission energy, including (Recommendation 7):

i. Setting a mandatory renewable energy target for the SWIS through to 2020 of the order of 15 to 20%, recognising the desirability of keeping costs consistent with the carbon price trajectory set out in Recommendation 11;

ii. Measures to provide further support for renewable and very low emission energy technologies, including geothermal, solar and wave technologies, which have significant potential for WA in the future, but that are not yet sufficiently developed to compete with established technologies (such as wind). Consideration should be given to:

- sub-targets for particular technologies set within the overall target;
- premium tariffs or subsidies per unit of energy supplied; and
- capital grants or concessional finance;

iii. Implementing a project facilitation service to assist projects to access finance, locate suitable sites and deal with planning, approval and grid connection processes and barriers; and

iv. Calling for expressions of interest to establish a pilot geothermal (hot dry rock) energy project in WA.

The Taskforce recommends that the WA Government (Recommendation 8):

i. Fast-track work to identify suitable geo-sequestration sites in WA;

ii. Facilitate a pilot geo-sequestration project in the Perth Basin; and

iii. Require all major new fossil fuel plants to plan for future carbon capture retrofits as carbon capture and storage (CCS) technology becomes available.

The Taskforce recommends that, the WA Government lead by example by (Recommendation 9):

i. Buying or leasing, and operating, minimum 5-star buildings or tenancies (subject to availability), buying the most efficient appliances in range, and ensuring all computer and office equipment is Energy Star compliant and enabled;

ii. Purchasing a greater proportion of Green Power for Government electricity use, establishing new energy efficiency targets for government agencies and extending its Carbon Neutral and Solar Schools programs;

iii. Establishing a program to progressively install cogeneration in government-owned hospitals and other appropriate institutions wherever possible; and

iv. Continue working closely with and assisting local government in their greenhouse gas abatement initiatives and programs.

It is imperative that WA improve its capacity and expertise in greenhouse policy, to ensure its policies and programs are focussed and effective in meeting the State's requirements; and that WA maintains a cutting edge capability in responding to issues and opportunities. The Taskforce recommends that the WA Government (Recommendation 2):

- Strengthen Government capacity and expertise in greenhouse policy development commensurate with the increasing priority of the issue.

B. Longer term policies, actions and strategies that the State should consider to assist its efforts to reduce GHG emissions

The Taskforce believes that, a suite of policies and measures will be required to drive emission reductions in the longer term, including complementary pricing signals provided through market mechanisms, mandatory minimum performance standards, technology development, fiscal incentives and voluntary programs that encourage best practice.

The Taskforce also recognises that targets provide a useful basis to guide government policy development and infrastructure investment, but should be set based on the best currently available knowledge and in expectation of global action.

To provide long-term direction for policy development and private investment, the Taskforce recommends that the WA Government (Recommendation 10):

- Adopt an indicative target to reduce emissions to a level of 50% below 1990 levels by 2050;

And in the short-term (Recommendation 11):

i. Develop an estimate of the future risk weighted carbon price trajectory;

ii. Base policy for achieving substantial emissions abatement by 2020 on this estimated carbon price trajectory;

iii. Determine indicative emission reduction profiles based on the carbon price trajectory; and

iv. Establish legislative triggers for progressive policy intervention every three to four years to strengthen policies if current measures fail to deliver the desired emission reductions toward the 2020 and 2050 objectives.

The Government has a key role in facilitating both 'technology push' through research and development and 'market pull' to drive technology deployment through pricing signals.

To facilitate longer term technology development, the Taskforce recommends that the WA Government (Recommendation 6):

i. Establish a dedicated and technically competent Greenhouse Technologies Development Unit to plan, coordinate and implement an Energy Technology Innovation Strategy;

ii. Assign the Greenhouse Technologies Development Unit, as a first task, to scope and plan the science infrastructure needs, including human resources, relevant to the development of world class research activity in emission reduction technologies in partnership with industry and academe;

iii. Establish a low emission technology development fund, to leverage significant Commonwealth and other public and private research and development expenditure to position WA industry to prosper in this field of economic opportunity, and to support research and development identified as high priority for WA.

iv Provide incentives to attract cutting edge projects and develop skills, critical mass and intellectual property in emerging low emission technologies which have particular relevance to the State's needs and competitive advantage;

v. Work with industry to undertake a detailed feasibility study for carbon capture networks in industrial regions;

vi. Undertake a detailed identification and assessment of potential sites for geo-sequestration of CO_2, geothermal, wind, wave and tidal energy development and review any barriers to deployment of these technologies;

vii. Establish policy measures to secure strategic geo-sequestration sites; and

viii. Encourage proponents of new energy intensive projects to provide financial contributions to the low emission technology fund.

Market pull measures are elaborated further under Terms of Reference E below.

C. The feasibility and implications of reducing GHG emissions by 50% by 2050

Potential emission reductions will depend on effective technological development and implementation, particularly in relation to energy efficiency, carbon capture and storage (CCS), and commercially viable sources of renewable energy. It is emphasised that achieving these savings will require immediate, strong and ongoing commitment to the policies and programs which the Taskforce has identified. It is also noted that the estimates are predicated to a large extent on effective action by the rest of the global community to provide for a price for carbon and to drive technological change.

While acknowledging the significant risks and uncertainties surrounding these caveats, the Taskforce has concluded that there is potential to return greenhouse gas emissions to current levels by around 2030. This provides a pathway towards deeper emissions cuts by 2050. However, it is clear that meeting a 50% reduction in emissions on 1990 levels by 2050 would require substantial new breakthroughs in energy technology.

In such a timeframe substantive technological breakthroughs are possible, particularly if driven by significant carbon prices, and effective support for research and development.

As the true price of greenhouse pollution is factored into investment decisions, low emission technologies will become more cost effective and new technologies are likely to emerge. Indeed, as the world moves towards a carbon constrained future, the high emission intensive technologies are likely to become increasingly unacceptable.

Low cost actions should commence immediately while those which have significant economic impact should be progressively implemented in concert with the global community and as technological developments occur. On this basis, emissions can be expected to continue to rise for some years before the recommended measures are effective in reducing emissions below the business-as-usual' trajectory.

D. Policy options that would be complementary to a National Emissions Trading Scheme that could be adopted in Western Australia in the short term

Price signals are critical to take proper account of the costs of greenhouse pollution, but a carbon price will not address all barriers to the use of low emission technologies.

The measures identified for terms of reference A, B, E and G all provide complementary measures that should be pursued in advance of, and alongside, an emissions trading scheme.

The Taskforce recommends that the WA Government (Recommendation 14):

i. Strengthen its capacity for greenhouse policy related economic analysis, including consideration of a specialist area and additional on-going resources;

ii. Initiate additional economic analysis on the following initial priorities:

- the existing extent of subsidies that encourage higher emissions and the opportunities to eliminate or reduce perverse subsidies;
- analysis of the likely costs and benefits of key emerging technologies, including for example CCS, geothermal and wave;
- underpinning modelling and data for drawing the proposed carbon price trajectory; and
- economic impacts on WA of market measures, particularly emission trading scheme design options.

E. Measures to prepare the State for such a National Emissions Trading Scheme and future integration with international emissions trading markets

The Taskforce considers a price signal implemented through a national emissions trading scheme to be a critical element of a comprehensive greenhouse policy, whether or not a global scheme is in place. Mechanisms to assist trade-exposed sectors should be put in place until a global scheme is implemented.

The Taskforce recommends that, in order to prepare WA for future carbon pricing, the WA Government (Recommendation 5):

i. Make a clear statement that, as a general principle, all new stationary energy developments will be liable for the full cost of future greenhouse gas emission compliance; and

ii. Foreshadow a future carbon price, develop a carbon risk analysis framework and consider imposing a requirement for project proponents to undertake a carbon price sensitivity analysis;

(Recommendation 12):

i. Endorse national emissions trading as a preferred domestic transition to a carbon constrained world;

ii. Continue to work with the National Emissions Trading Taskforce towards a national scheme involving the Commonwealth, the States and Territories;

iii. Support implementation of the National Emission Trading Scheme based on:

- a phased approach to sectoral coverage commencing with the electricity generation sector;
- assistance for adversely affected firms through the allocation of permits;
- assistance for trade-exposed energy intensive industry to account for the impacts of the scheme on individual projects; and
- inclusion of offsets.

F. Proposals for energy conservation initiatives focused on encouraging businesses and householders to make significant reductions in energy consumption

The Taskforce has identified cost-effective energy efficiency measures that can deliver more than 24 Mt of greenhouse gas abatement annually by 2030. There are a range of barriers, including price, that exist to the use of more energy efficient appliances, buildings and industrial equipment.

The Taskforce recommends that, to harness cost effective efficiency opportunities and reduce energy waste the WA Government (Recommendation 3):

i. Improve pricing signals in energy markets through carbon pricing, mandatory use of smart metering, tests for network augmentation and allowing Western Power to recover foregone revenue from demand side investments;

ii. Support and extend energy rating and labelling;

iii. Implement world class minimum energy performance standards for appliances, homes, office buildings and industrial equipment, extend their coverage, factor in a carbon price and regularly review standards to keep pace with technology development;

iv. Establish a mandatory energy efficiency program for large to medium energy users, initially to ensure that efficiency opportunities that offer no regrets greenhouse savings to the community as a whole are implemented; and

v. Establish an Energy Savings Fund, based on the NSW model of a small surcharge on energy consumption, to identify and invest in energy savings, home energy retrofitting, awareness raising, incentives, rebates and energy auditing for small and medium enterprises.

G. Policy proposals for Government consideration on greenhouse offsets that would provide clear ground rules for proponents of projects that will have significant greenhouse emissions

The Taskforce supports the use of offsets and recognises that for an offset to be credible it must be:

- Additional to any regulatory requirements and what might have otherwise occurred in response to mandatory requirements or through voluntary action;
- Secured on a permanent basis, with arrangements for risk management and ongoing integrity of the abatement;
- Quantifiable using consistent, robust and verifiable approaches that are internationally recognised; and
- Demonstrating clear legal ownership.

The Taskforce recommends that, in establishing a WA offset regime, the WA Government (Recommendation 13):

i. Promote the establishment of a national registry to govern offset creation, registration and trade and provide a set of common offset rules for all national programs;

ii. Seek compatibility with international rules for offsets;

iii. Establish a WA registry:

- to manage WA offsets as an interim measure before a national registry is in place; and
- to manage WA offsets that meet international requirements but are not recognised nationally;

iv. Establish a regulatory body to determine the parameters and establish procedures to ensure that offset standards are applied and that there is no double counting; and

v. Assess the WA potential for offset supply and facilitate their supply through government programs.

Appendix 1
Full Taskforce membership, Secretariat and Terms of Reference

Independent members

Dr Roy Green, AO, FTSE (Chair)

Former Deputy Chair of the WA Environmental Protection Authority, Dr Green has undertaken senior roles throughout his career in Australia, such as Chief Executive Officer of the CSIRO, Chairman of the National Land and Water Resources Audit and President of the Murray Darling Basin Commission.

Mr John Akehurst

CEO of Biostarch Pty Ltd, Director of Alinta and Coogee Resources and the former CEO of Woodside Petroleum Ltd.

Mr Richard Begley

Director of Insight Economics and a specialist in greenhouse and sustainable energy economics.

Dr John Zillman, AO, FTSE, FAA

President of the Australian Academy of Technological Science and Engineering, Dr Zillman is a former President of the World Meteorological Organization, former head of the Australian Bureau of Meteorology and a former Principal Delegate of Australia to the Intergovernmental Panel on Climate Change.

Ms Cathy Zoi

Group Executive Director of The Bayard Group and former Chief of Staff of environmental policy in the Clinton White House.

Ex-officio government members

Department of the Premier and Cabinet: Mr Rosh Ireland, Director.

Office of Energy: Ms Ann Nolan, Coordinator of Energy (Aug 05 to April 06); Mr Jason Banks, Acting Coordinator (from April 06)

Department of Industry and Resources: Dr Bruce Hobbs, State Chief Scientist (Aug 05 to Feb 06); Mr Ian Briggs, General Manager (from March 06)

Department of Treasury and Finance: Ms Nicky Cusworth, Director

Department of Environment and Conservation: Mr Robert Atkins, Director (Aug 05 to Feb 06); Mr Rob Sippe (from March 06)

It should be noted that, while ex-officio members have provided valuable support and expertise to the Taskforce, final decisions on the report and its recommendations were made by the Independent Members only.

Taskforce Secretariat

Mr Hazli Koomberi, Program Manager (from Sept 05)

Mr Alan May, Project Officer (Nov 05 to March 06)

Ms Brooke Eddington, Project Officer (from Jan 06)

Additional Specialist Support

Mr Charles Crouch, Senior Manager Industry; Mr Julian Fairhall, Senior Analyst; Office of Energy

Dr Joseph Patroni, Manager, Department of Industry and Resources

Mr Richard McKellar, Manager, Department of Environment and Conservation

Ms Caroline Van Tilborg, Principal Economist, Department of Environment and Conservation

Greenhouse Policy Unit, Department of Environment and Conservation

Ms Alex Gordon was contracted to provide advice on the report.

Terms of Reference

The Greenhouse and Energy Taskforce was formally established on 30 May 2005 to provide advice to WA Cabinet on the following matters:

A Practical and economically feasible policies to manage GHG emissions from the stationary energy sector in the short term;

B Longer term policies, actions and strategies that the State should consider to assist its efforts to reduce GHG emissions;

C The feasibility and implications of reducing GHG emissions by 50% by 2050;

D Policy options that would be complementary to a National Emissions Trading Scheme that could be adopted in Western Australia in the short term;

E Measures to prepare the State for such a National Emissions Trading Scheme and future integration with international emissions trading markets;

F Proposals for energy conservation initiatives focused on encouraging businesses and householders to make significant reductions in energy consumption; and

G Policy proposals for Government consideration on greenhouse offsets that would provide clear ground rules for proponents of projects that will have significant greenhouse emissions.

Appendix 2

The scientific basis for concern with the threat of climate change

The current global concern with the threat of (human-induced) climate change was initially triggered by scientific arguments (first brought to the attention of governments in the 1980s) that increasing concentrations of carbon dioxide and other greenhouse gases would enhance the atmosphere's natural greenhouse effect (the process through which atmospheric absorption of infrared radiation from the Earth's surface 'traps' heat in the lower layer and keeps the Earth's surface some 30oC or more warmer than it would otherwise be) and lead to global warming and other global, regional and local changes of climate.

The initial statements of concern from within the climate science community were evaluated through the late 1980s and early 1990s through a governmentally-supervised and broadly based expert scientific assessment mechanism known as the Intergovernmental Panel on Climate Change (IPCC) whose 'First Assessment Report', issued in mid-1990, largely confirmed the earlier basis for concern and provided the scientific basis for the negotiation of the Framework Convention on Climate Change (FCCC) which was signed by 155 countries at the Rio Earth Summit in June 1992. The stated objective of the FCCC, which came into force in 2005, is to achieve 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner'.

Much of the international research into the mechanisms and predictability of climate change over the past decade (and a principle focus of attention in the IPCC's Second (1996), Third (2001) and forthcoming Fourth (2007) Assessment Reports) has been aimed at assisting policy makers to identify the level of greenhouse gases that would produce 'dangerous anthropogenic interference with the climate system', and the strategies and measures that the global community would have to pursue to achieve stabilisation of greenhouse gas concentrations at or below that level.

While many uncertainties remain in the science, and especially in the climate system models used to project future global climate patterns for a range of hypothetical future greenhouse gas concentrations, the current international state of the science can be summarised as follows:

- Over the past 50 years, but especially over the past decade, global mean temperatures have continued to rise, roughly as the climate models indicate they should have, in response to the observed increases in concentrations of greenhouse gases;
- The models 'project' further greenhouse warming (of the order of tenths of a degree per decade) for all plausibly realistic scenarios of global greenhouse gas emissions over the next century;
- It is not yet possible to provide confident projections of future climate change at the regional or local level (beyond a fairly confident expectation of a general warming trend), including changes to rainfall patterns and the frequency of extreme events, or to predict how such human-induced changes as may occur will be amplified or suppressed by the natural variability of the climate system;
- There is an emerging, though still very tentative, scientific/political consensus from impact and vulnerability research that carbon dioxide concentrations significantly in excess of 450 ppmv (i.e. an increase of 70 ppmv over present concentrations of 380 ppmv and 170 ppmv above pre-industrial concentrations) will lead to 'dangerous anthropogenic interference with the climate system';

- In order to stabilise carbon dioxide concentrations at or below 450 ppmv, it will be necessary to reduce global emissions to less than half of 1990 levels by mid-century.

The objective of reducing carbon dioxide emissions from stationary energy sources in Western Australia to 50% of 1990 levels by 2050 would thus be consistent with what the present international state of knowledge suggests would be required to avert dangerous human interference with the climate system.

It is important to understand, however, that there is not, as yet, (and is unlikely ever to be) any clearly establishable scientific linkages between:

- Past Western Australian greenhouse gas emissions and recent adverse changes (especially reduced rainfall) in Western Australian climate; and
- Any future reductions in Western Australian emissions and the future evolution of the climate of Western Australia.

The forthcoming (2007) Fourth Assessment Report of the IPCC is expected to generally reinforce the findings of the 2001 Third Assessment Report and, in particular, to:

- Assign higher levels of confidence to the attribution of the observed global warming (and certain other observed climate trends) to the build-up of greenhouse gases in the atmosphere; and
- Provide more confident projections of future patterns of climate change for the various given emission scenarios.

It is expected that the IPCC Fourth Assessment Report will provide the main scientific underpinning to the negotiation of an international greenhouse gas reduction regime to succeed that for the 2008-12 period covered by the 1997 Kyoto Protocol to the FCCC.

Appendix 3
WA Greenhouse Strategy 2004 - Stationary energy actions

– A Western Australian Greenhouse Inventory will be established, based on mandatory annual reporting by agencies and businesses identified in 2004 as significant emitters, at decreasing trigger points.

– Western Australian emitters of greenhouse gases who are not required to report to the Inventory will be able to voluntarily join the mandatory scheme from 2007–08.

– A summary of the Western Australian Industrial Greenhouse Inventory will be released for public information every three years and provided to the National Greenhouse Gas Inventory (NGGI).

– Annually provided data will be audited against the operation of the company and its plants for the purposes of verification. Audits will be conducted on a three-year cycle. Information provided for the purpose of the audit will be treated as commercial-in-confidence.

– All emitters that are required to report their greenhouse gas emissions to the Inventory will also be required to (a) annually prepare and lodge greenhouse gas emission estimates for the coming year by total and by intensity; and (b) develop strategies to minimise anticipated emissions. Strategies will be required to be lodged annually from the year after emissions are first reported.

– Western Australia will determine its preferred models for greenhouse emissions abatement and promote these nationally.

– A Western Australian Greenhouse Abatement Fund will be established to encourage the development of a stable and confident emissions trading marketplace and to manage government-owned carbon rights and emission credits.

- A Western Australian Greenhouse Registry will be established to document and certify carbon credit sequestration and emission reductions achievements.

- Western Australia's involvement in a confident and viable carbon trading market will be promoted, preferably on a national and international basis.

- The Western Australian Government will investigate with other jurisdictions the viability of possible national emissions trading and abatement models.

- For trading purposes, the unit of exchange in the purchase and sale of certificates will be based on the $ per tonne of C02e.

- The Western Australian Government will establish efficient energy markets facilitating greater investment in renewable energy and demand side management initiatives that enhance the efficiency of energy supply and use.

- The Western Australian Government will undertake an independent study to examine ways to maximise the renewable energy potential of the South West Interconnected System.

- The Western Australian Government will commission a study that will explore the potential for demand management and energy efficiency to participate in the electricity market.

- The Western Australian Government will continue to support the use of renewable energy and the development of renewable energy technologies throughout the State.

- Electricity retailers will be required to test the local market in sourcing Renewable Energy Certificates (RECs) to meet their Mandatory Renewable Energy Targets (MRET) requirement.

- In procuring RECs, Western Power will continue to give priority to certificates created by projects located in the State.

- The Western Australian Government will provide a fixed term subsidy of 1c/kWh for new renewable electricity generation projects not selected under Western Power's first RECs procurement process and not eligible for Remote Renewable Power Generation Program (RRPGP) funding.

Appendix 4
Work prepared for the Taskforce

1. Working papers

Title	Author
Greenhouse gas emissions from stationary energy projections in WA	Office of Energy
Coal fired power station offsets	Office of Energy
Offset regimes in Australia	Office of Energy
Economic models of emission trading schemes	Greenhouse Unit
Energy conservation in WA	Greenhouse Unit
Emissions trading background document	Greenhouse Unit
Renewable energy in WA	Greenhouse Unit and Office of Energy
Cogeneration opportunities in Western Australia	Office of Energy
Energy conservation measures	C. Zoi and R. Begley
Western Australian Greenhouse Strategy 2004: Stationary energy actions	Greenhouse Unit
The role of GHG offsets	Greenhouse Unit
Brief descriptions of GHG emission reduction technologies	Office of Science and Innovation

2. External work commissioned (Contained in the attached disk at the back of the report)

Title	Author
Supply Side Options for WA Stationary Energy: An assessment of alternative technologies and development support mechanisms	Next Energy Pty Ltd
A Review of Energy and Greenhouse Gas Emission Projections for Western Australia	ABARE
Emissions Trading - Options for Western Australia	Insight Economics Pty Ltd
Energy Efficiency Potential in Western Australia	Energetics Pty Ltd
Technology outlook for stationery energy in Western Australia	Dr J Patroni
Energy Efficiency: Policy Measures to Reduce Greenhouse Gas Emissions	Insight Economics Pty Ltd

Appendix 5
Uncertainties in emissions projections for WA

This appendix provides a brief discussion of uncertainty in emissions projections, with reference to estimates of WA's greenhouse gas (GHG) emissions projections to 2030 and beyond developed by ABARE. ABARE do not provide uncertainty analysis, so this Appendix outlines indicative estimates of high and low uncertainty around the ABARE 'best estimate'.

GHG emissions projections are generally derived from either:

- Top down economic models, that relate emissions to economic activity variables such as GDP, productivity; or
- Bottom up engineering models that relate emissions to particular supply side technologies, and associated variables such as emissions per unit of production.

ABARE's emissions projections for WA utilise their E4Cast bottom up model, and so are of the second type. Despite somewhat greater precision in relation to the supply side, the bottom up method still requires a demand side projection, which has comparable uncertainty to the top down approach.

Uncertainty in developing economic projections is generally assessed through use of either sensitivity or scenario analysis. Full statistical analysis is generally precluded due to computational and size problems. As a result, it is only possible to assess a proportion of total uncertainty.

Stationary energy sector projections

Australia's national Stationary Energy sector GHG emissions projections are developed by the Australian Greenhouse Office (AGO). Uncertainty is addressed by averaging the results of four different models (ABARE GTEM, Monash MMRF-Green, ABARE E4Cast, MMA Strategist), by developing composite 'high' and 'low' scenario estimates around a central 'best estimate', and by examining the sensitivity of projections from each model to changes in key parameters (GDP, population, end use efficiency improvement, supply side efficiency improvement, share of gas fired generation). The sensitivity analysis suggests the projections are most sensitive — by a significant margin — to overall levels of economic growth.

The AGO's Stationary Energy projections run out to 2019-20. Combined national model uncertainty is estimated as:

- high and low emissions are for ±5 per cent around the best estimate at 2010; and
- high and low emissions are for ±5 per cent around the best estimate at 2020.

It is worth noting that from the sensitivities reported by the AGO, the E4Cast model exhibits the least sensitivity to changes in key parameters.

For WA's emissions, it could be reasonable to apply this 'estimate' of Australia-wide uncertainty to the WA emissions projection — if it was believed that WA had the same level of uncertainty as the Australian average. In reality, however, the Australia-average uncertainty is likely to be an underestimate for a smaller economy such as WA, that is less diversified and more commodity export dependent than the rest of Australia, particularly as the projections horizon grows.

Thus it is justifiable to increase the uncertainty interval for WA Stationary Energy projections. One reasonable judgment might be to apply a rate that grows to just under double the Australia-wide estimate by 2020 (that is ±5 per cent around the ABARE best estimate at 2010, growing annually to ±10 per cent by 2020), and to treble this by 2030 (±15 per cent). Beyond 2030, uncertainty is more difficult to judge.

Fugitive sector projections

Fugitive GHG emissions projections are developed by the AGO, also to 2019-20. A large component of natural gas fugitive emissions arises in WA. Uncertainty for the fugitive gas component is estimated as:

- +21/-40 % around the best estimate at 2010; and
- +18/-50 % around the best estimate at 2020.

In the gas sub-sector of fugitive emissions, the uncertainty largely relates to the timing of major LNG projects and also whether they will be required to sequester their fugitive emissions.

Despite the potentially significant change in outlook for this sector in the past year or so, it is reasonable to adopt an estimate for uncertainty roughly similar to that above, and to apply this to the flaring and venting emissions estimated by ABARE for WA.

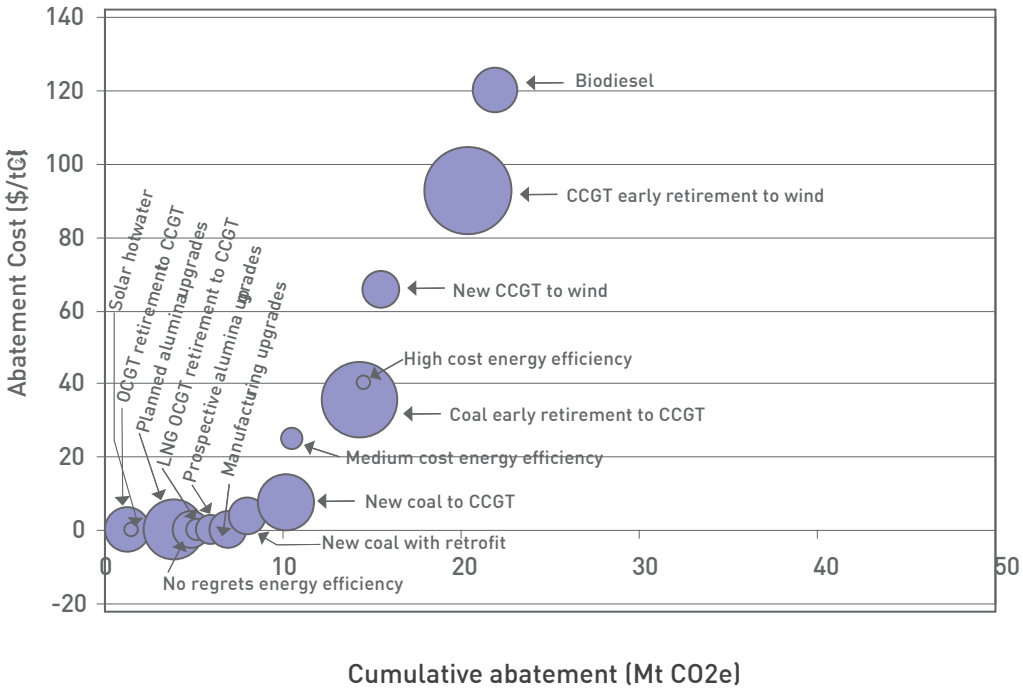
Overall then, high and low uncertainty is judged to grow from around +20/-40 per cent at 2010, to +20/-50 per cent by 2020. This uncertainty is judged to grow further to +30/-60 per cent by 2030.

Appendix 6
Cost curves for abatement in 2010, 2020 and 2030

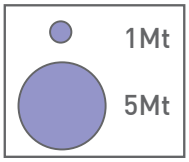
The level of potential abatement increases significantly over time

The following abatement cost curves summarise the abatement potential identified from currently available low emission technologies, and from emerging technologies that are anticipated to be ready for deployment by 2020 if anticipated economic and technological trends are realised, with anticipated costs between now and 2010, 2020 and 2030 relative to the ABARE business-as-usual emission projections. Each circle represents a different abatement opportunity. The clear trend, however, is for more abatement over time at lower cost.

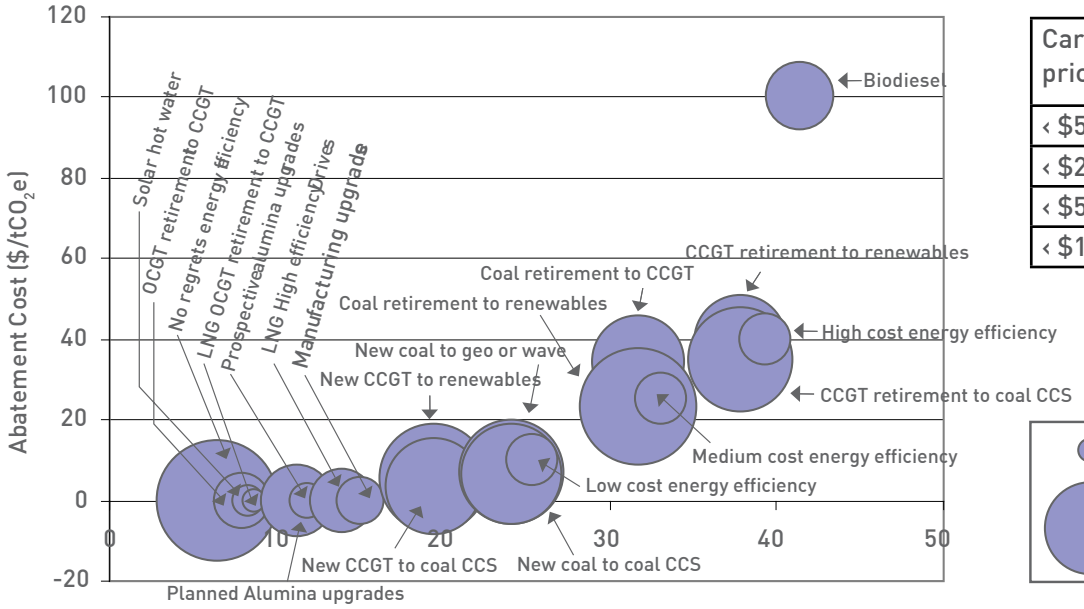
Abatement potential in 2010



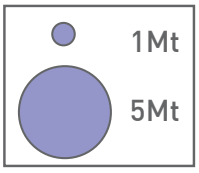
Carbon price	Abatement potential
‹ $5	7.0 Mt
‹ $20	7.0 Mt
‹ $50	10.8 Mt
‹ $100	16.7 Mt



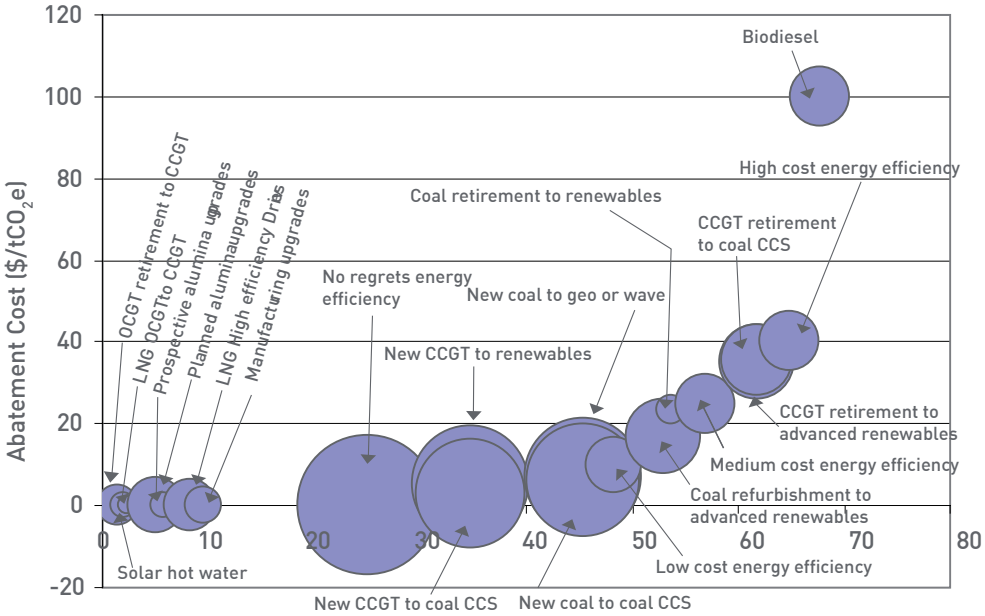
Abatement potential in 2020



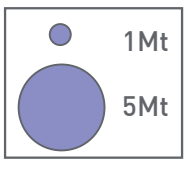
Carbon price	Abatement potential
‹ $5	13.0 Mt
‹ $20	17.6 Mt
‹ $50	28.8 Mt
‹ $100	30.9 Mt



Abatement potential in 2030



Carbon price	Abatement potential
‹ $5	19.0 Mt
‹ $20	34.5 Mt
‹ $50	40.3 Mt
‹ $100	43.2 Mt



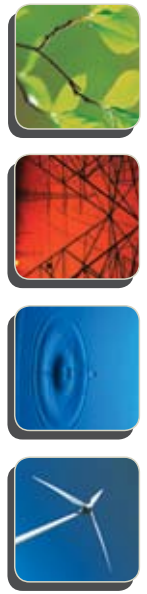
Appendix 7
Modelled economic impacts of National Emissions Trading Scheme scenarios

Scenario 1	National electricity generation combustion emissions were capped at 176 Mt CO2e by 2030. The 176 Mt CO2e cap would be equivalent to returning electricity generation sector emissions to around year 2000 levels.
Scenario 1a	As per Scenario 1, but with sensitivity for enhanced energy efficiency uptake, 'induced technical change' (ITC) and enhanced forestry biosequestration.
Scenario 2	National electricity generation combustion emissions were capped at 150 Mt CO2e by 2030, equivalent to returning electricity generation sector emissions to around year 1997 levels.
Scenario 4	This scenario assessed the carbon price under a NETS required to just prevent the uptake of new coal fired electricity generation in Australia.
Scenario 4a	This scenario assessed the carbon price under a NETS required to just prevent the uptake of new coal fired electricity generation in Australia, but starting with significantly higher gas prices in Western Australia.

Impact of NETS under various scenarios at 2020

Technology	Base case		Scenario 1		Scenario 1a		Scenario 2		Scenario 4		Scenario 4a	
	Aus	WA	Aus	WA	Aus	WA	Aus	WA	Aus	WA	Aus	WA
Total Emissions												
Level (Mt CO2e)	634	98	580	90	585	93	572	92	602	91	600	91
Deviation from the base case (%)	-	-	-8.6	-8.2	-7.7	-4.8	-9.8	-6.2	-4.9	-6.8	-6.7	6.8
GDP												
Level ($b 2005)	1,267	167	1,261	167	1,263	167	1,260	167	1263	167	1263	167
Deviation from the base case (%)	-	-	-0.4	-0.1	-0.3	+0.1	-0.5	+0.1	-0.3	+0.1	-0.3	+0.2
Private consumption												
Level ($b 2005)	686.7	75.8	682.6	75.7	684.0	75.7	682.1	75.7	683.9	75.7	683.9	75.9
Deviation from the base case (%)	-	-	-0.6	-0.2	-0.4	-0.1	-0.7	-0.2	-0.4	-0.1	-0.4	0.0
Labour market												
Jobs ('000s)	11,301	1,342	11,299	1,343	11,304	1,342	11,296	1,343	11,301	1,342	11,301	1,343
Deviation from base case (%)	-	-	-0.1	0.1	0.1	0.1	-0.1	0.1	0.0	0.0	0.0	0.1
Real wage deviation from base case (%)	-	-	-1.0	-1.0	-0.5	-0.5	-1.1	-1.1	-0.7	-0.7	-0.7	-0.7
Time in months to recover base case private consumption levels	-	-	1.9	0.8	1.3	0.6	2.2	1.0	2.0	0.6	2.0	-0.1

Source: Insight Economics (2006):Emissions Trading – Options for Western Australia, Report for the Greenhouse and Energy Taskforce



Appendix 8
Stakeholders consulted

Greenhouse Interdepartmental Committee

- Department of Agriculture and Food
- Department of Conservation and Land Management
- Department of Environment
- Department of Health
- Department of Housing and Works
- Department of Industry and Resources
- Department of Local Government and Regional Development
- Department of Planning and Infrastructure
- Department of Premier and Cabinet
- Department of Treasury and Finance
- Forest Products Commission
- Office of Energy
- Sustainable Energy Development Office
- Water Corporation
- Western Power Corporation

High Level Stakeholder Group on Greenhouse

- Australian Conservation Foundation
- Australian Greenhouse Office
- Australian Petroleum Production and Exploration Association
- Chamber of Commerce and Industry
- BHP Billiton
- BP Western Australia
- Chamber of Minerals and Energy
- Conservation Council WA
- Insurance Council of Australia
- Planning Institute of Australia, WA Division
- Rio Tinto
- Unions WA
- Urban Development Institute of Australia
- WA Council of Social Services
- WA Sustainable Energy Association
- Western Australian Farmers Federation
- Western Australian Local Government Association
- Woodside
- WWF-Australia

DISCLAIMER

The Greenhouse and Energy Taskforce has taken reasonable care in preparing this document from information prepared for the Taskforce and from publicly available information, but accepts no responsibility for any loss by any person or any organisation that relies on information in this document.

The purpose of this document is to provide advice to the Western Australian Government on managing the reduction of greenhouse gas emissions in the stationary energy sector.