Australian Government

SECURING **AUSTRALIA'S** ENERGY FUTURE

Prime Minister
CANBERRA

PRIME MINISTER'S FOREWORD

Our nation's enormous energy resources are a source of considerable prosperity for all Australians. They provide access to low cost energy for businesses and households across the land. Energy exports deliver more than $24 billion a year in export income to Australia, and low-cost energy supports the competitiveness of significant parts of our industrial base. Our energy industries, which directly employ 120 000 Australians, have an enviable record of providing energy when and where it is needed.

Looking forward, Australia has an opportunity to play a major role in supplying the world with energy, and energy-related products. Australia remains the largest exporter of coal. New and existing projects—such as the North West Shelf gas project—will provide billions of dollars of export income and economic activity into the future. Proposals for developing other large gas fields are being actively worked on. Continuing the reliable delivery of competitively-priced energy to industry and households will underpin jobs and growth.

Australia must grasp this opportunity while improving the sustainability of energy production and use. Energy is a major contributor to global greenhouse gas emissions, and although Australia is a small contributor to global emissions, we will play an active role in developing an effective global response to climate change. We will also move strongly to reduce the cost of meeting any future greenhouse constraints, without harming the competitiveness of our energy and energy dependent industries in the meantime. Our goal is to place Australia in a strong position to respond to the challenge of climate change, while maintaining a prosperous economy.

Three themes—prosperity, security, and sustainability—underpin the government's approach to energy policy. The Australian Government has undertaken a comprehensive review of its energy policies and approaches, and has developed a long-term framework to ensure our energy advantage is utilised for the benefit of all Australians.

The framework is backed up by substantial new initiatives, including additional incentives to encourage petroleum exploration in frontier areas; a comprehensive reform of fuel taxation to reduce the cost of fuel in business use; innovative trials of solar technology teamed with leading edge efficiency technologies to demonstrate "solar cities" of the future; a fund to generate at least $1.5 billion in investment to demonstrate low-emission technologies to reduce greenhouse gas emissions from our energy sector; extra effort to back up our world first Renewable Energy Target with new commercialisation assistance for emerging renewable technologies; and a wide ranging effort to ensure the careful, prudent use of our valuable energy resources by industry and the community.

The policy framework outlined in this statement has a single, simple purpose—to secure Australia's energy future.

(John Howard)

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OVERVIEW

Australia entered the 21st century as one of the leading economies of the world. Australia's sustained economic growth, high labour and general productivity, and strong environmental record provide continuing prosperity for the nation.

Australia's energy sector has played a key role in this success. Development of Australia's vast energy resources has provided low-cost energy for Australians, and substantial export income. More competitive energy markets and an effective response to domestic and global environmental issues further underpin the substantial contribution energy makes to Australia's economy and lifestyle.

Australia's access to low-cost energy also underpins much of our industrial base. Exports of energy earn Australia more than $24 billion a year. The nation's energy resources also provide the competitively priced power needed for key industries such as aluminium, cement, steel, and paper. The energy sector is a major employer, directly providing jobs for 120 000 Australians, and supports many hundreds of thousands more in the broader community.

AUSTRALIA'S ENERGY SECTOR

Australia's energy sector spans the production and supply of stationary energy (such as electricity and gas), transport energy (mainly petroleum based fuels) and energy for export.

The sector encompasses the identification and development of primary energy sources such as coal, gas, oil and uranium, as well as renewables like hydro-electricity, wind, solar and biomass. It includes the conversion of the raw, primary energy sources into final energy sources such as electricity and refined petroleum fuels and their delivery and marketing to final consumers.

Australians spend about $50 billion on energy each year, while energy exports earn more than $24 billion a year. The sector involves massive, long-lived capital items such as electricity plants, transmission lines, coal, oil and gas production facilities, pipelines, refineries, wind farms as well as a multitude of smaller facilities such as wholesale and retail distribution sites.

The production and use of energy comes with a major environmental challenge. Energy is the largest single contributor to global emissions of greenhouse gases. Transport emissions are a significant source of urban air pollution. Energy projects can affect Australia's air and water quality, biodiversity, noise levels and heritage, and must be sensitively managed. The new technologies and practices needed to meet this challenge provide opportunities for new industries to emerge.

Demand for energy in Australia is projected to increase by 50 per cent by 2020, and the energy industry has estimated that at least $37 billion in energy investments will be required by 2020 to meet the nation's energy needs. Meeting this increased demand for energy, while moving to a low-emissions future, is a key challenge facing Australia's future growth and living standards.

The Australian Government's objective is to ensure that Australians have reliable access to competitively priced energy, the value of energy resources is optimised, and environmental issues are well-managed. This Energy White Paper sets out a comprehensive and integrated approach to meeting these energy objectives of prosperity, security and sustainability.

A NATIONAL STRATEGY TO DELIVER PROSPERITY, SECURITY AND SUSTAINABILITY

To achieve energy prosperity, security and sustainability, the government has put in place policies to:

- attract investment in the efficient discovery and development of our energy resources for the benefit of all Australians
- deliver a prosperous economy while protecting the environment and playing an active role in global efforts to reduce greenhouse emissions
- encourage development of cleaner, more efficient technologies to underpin Australia's energy future
- develop effective and efficient energy markets that deliver competitively priced energy, where and when it is needed into the future
- minimise disruptions to energy supplies and respond quickly and effectively when disruptions occur
- establish an efficient energy tax base, restricting fuel excise to end use and applying resource rent taxes to offshore projects
- ensure Australia uses its energy wisely.

MAJOR NEW ACTIONS

Initiatives announced in this White Paper to achieve the Australian Government's energy objectives include:

- a complete overhaul of the fuel excise system to remove $1.5 billion in excise liability from businesses and households in the period to 2012–13
- the establishment of a $500 million fund to leverage more than $1 billion in private investment to develop and demonstrate low-emission technologies
- a strong emphasis on the urgency and importance of continued energy market reform
- the provision of $75 million for Solar Cities trials in urban areas to demonstrate a new energy scenario, bringing together the benefits of solar energy, energy efficiency and vibrant energy markets
- the provision of $134 million to remove impediments to the commercial development of renewable technologies
- incentives for petroleum exploration in frontier offshore areas as announced in the 2004-05 budget
- new requirements for business to manage their emissions wisely
- a requirement that larger energy users undertake, and report publicly on, regular assessments to identify energy efficiency opportunities.

DEVELOPING OUR RESOURCES

Developing Australia's abundant low-cost energy resources is a key to our future prosperity. Australia is the world's fourth largest producer, and largest exporter, of coal. We supply 8 per cent of the world trade for liquefied natural gas, and possess 40 per cent of the world's low-cost uranium reserves. Our known oil reserves are significant, but are projected to decline in the absence of new discoveries. Australia has significant wind and solar resources, and limited large hydro resources. Investment committed on energy projects under development in Australia totalled $11.1 billion at April 2004 and a further $38.8 billion in investment is under consideration (ABARE 2004).

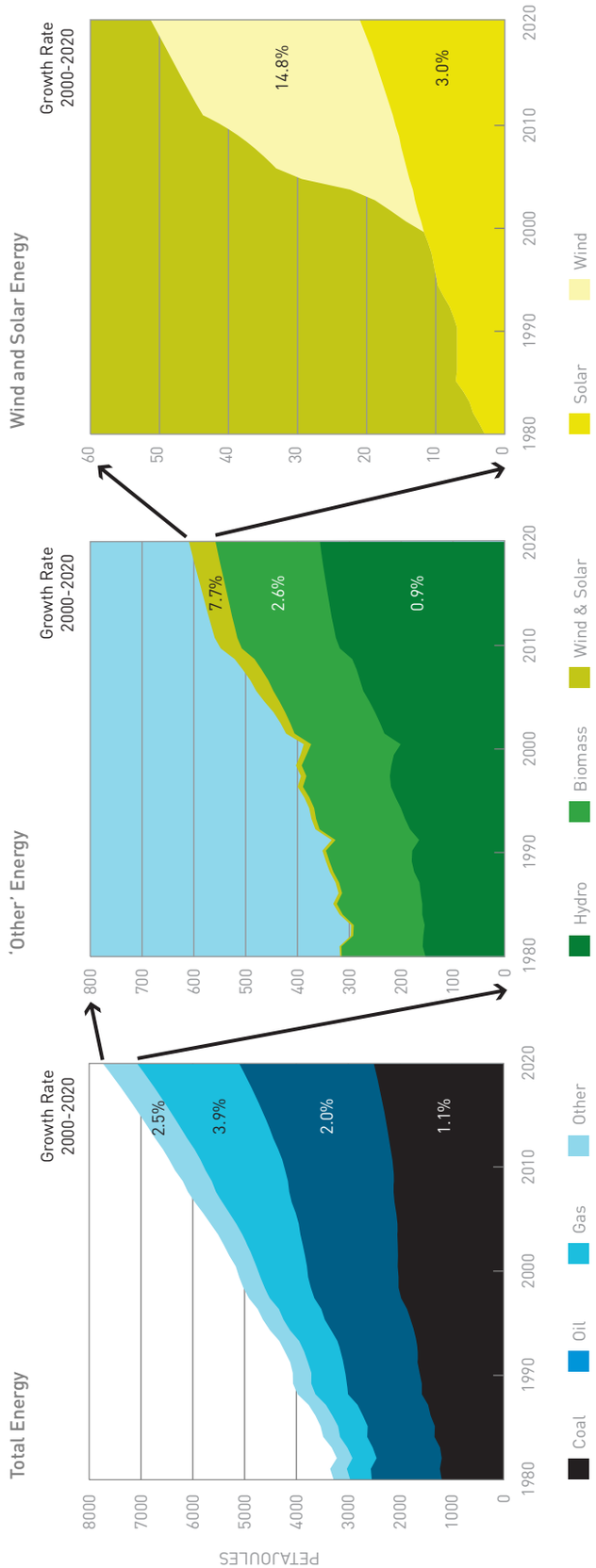
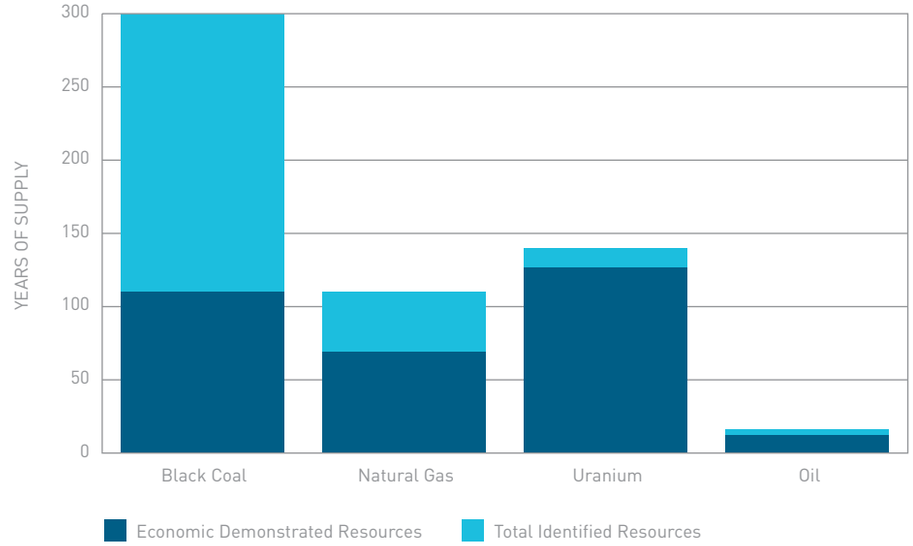


Figure 1: Composition of Australian energy supply

Source: ABARE FES data for 1980 to 2000 and Australian energy projections for 2001 to 2020

Further development of this country's energy resources benefits all Australians. Australia can, and should, continue to play a major role in supplying the domestic and world economies with low-cost energy. Australia has sufficient energy resources to last many years, and is lightly explored compared with many parts of the world. For the foreseeable future, coal, oil and gas will meet the bulk of the nation's energy needs with gas, wind, solar and biomass increasing their share of Australia's energy supply.

Figure 2: Depletable resources at current production levels



Note: Brown coal economic demonstrated resources of 560 years and total identified resources of 2900 years. Source: Geoscience Australia 2004

Our country is not alone in seeking to develop its energy resources, posing a considerable challenge for Australia. Global competition is fierce for the billions of dollars in investment needed to develop major resources. These investments often take many years of exploration, development and operation before generating positive returns, and the cost and risks of exploration are high, especially in offshore waters.

Providing an attractive environment for investment

Providing an attractive environment for these investments is a high priority for the government. Australian Government policy provides investors with the freedom to act commercially and earn reasonable returns, while compensating the community for the use of its resources and ensuring that environment and social issues are managed well.

Australia's stable political system, certainty of tenure, relatively low levels of red tape, and flexible labour relations are key strengths in attracting investors. These advantages have come about, not by accident but by focussed government decision making. According to the Resource Stocks World Investment Risk Survey of 2003 Australia ranked number one in the world across a wide range of risk factors for energy and mineral investments.

Table 1: World Investment Risk Survey, 2003

	Sovereign risk	Land access	Green tape	Land claims	Red tape	Social risk	Infrastructure	Civil unrest	Natural disasters	Labour relations	Ranking
Australia	**0**	**3**	**3**	**4**	**2**	**1**	**1**	**0**	**1**	**2**	**1**
Canada	0.5	3	3	3	3	2	1	0	1	2	2
USA	0	3	4	3	3	2	1	1	1	2	3
Chile	2	2	2	2	2	2	2	2	2	2	4
South Africa	3	2	2	2	3	3	2	3	1	2	22
Indonesia	3	3	3	3	4	3	3	4	3	3	23
PNG	4	3	2	4	3	4	4	4	3	3	24
Zimbabwe	5	4	2	4	4	4	3	5	2	3	25

Note: This survey covers both minerals and energy resource investments. Higher numbers indicate higher risk.
Source: Resource Stocks, World Investment Risk Survey 2003

The Australian Government is determined to protect and build on this advantage by allowing commercial decisions to determine the timing and nature of resource developments and by streamlining the nation's compliance requirements to allow developments to proceed in a timely fashion.

Australia is a vast nation, and while its coal resources are often located close to population centres, many of its energy resources are in remote locations. Much of Australia remains very lightly explored, especially for petroleum. Recent discoveries of petroleum have been mainly offshore and gas-based, with large fields being identified in the north and north-west. Project proponents are actively pursuing development options for these fields, like Gorgon in the North West, and Sunrise in the North. Smaller finds are also being developed in a range of areas, including off the south-east coast.

Identifying and assessing Australia's resources is the first step in developing them. Australian governments increase the attractiveness of exploration by providing high-quality geoscience data that identify areas likely to contain energy and other resources. Governments collectively spend around $90 million a year providing geoscience data, which underpins further exploration by the private sector.

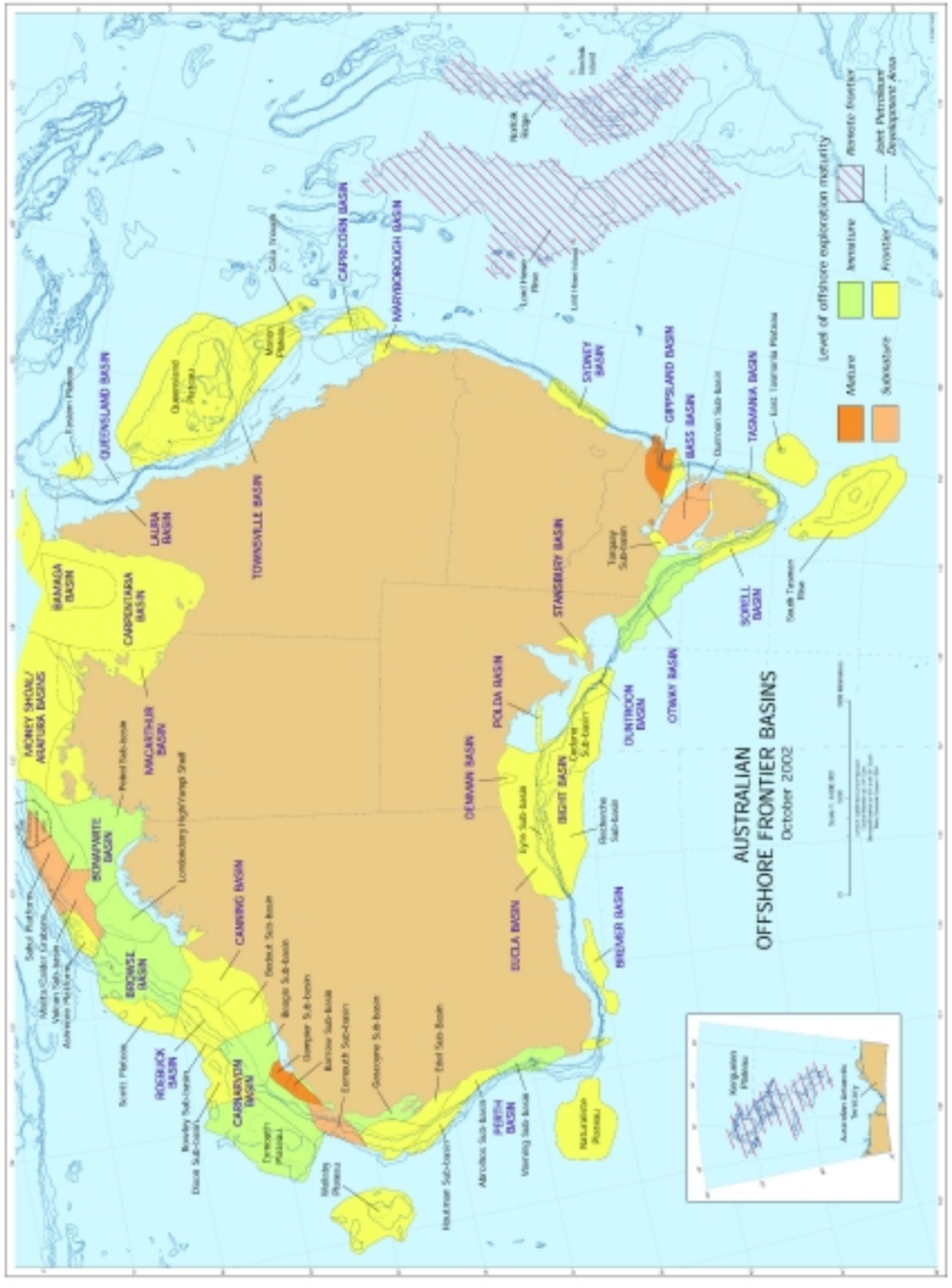
Improving these data is a key priority for the Australian Government, which will work closely with the states and territories to improve the consistency, availability and overall quality of geoscience data. In the 2003–04 Budget, the government announced funding of $61 million over four years for Geoscience Australia's core Petroleum programme and seismic data acquisition and preservation. Of this amount $25 million is to generate new geoscience data to further encourage exploration in offshore frontier areas.

Australia's fiscal regime for the development of its offshore petroleum resources is world-class. Reforms to the company tax system in 1999 improved its efficiency and lowered the company tax rate from 36 per cent to 30 per cent. Australia's Petroleum Resource Rent Tax (PRRT) is recognised as one of the best systems of secondary taxation in the world. This system allows investors to earn a reasonable rate of return and gives time for investors to recoup sunk costs before providing a revenue stream to government.

Geoscience data have identified a range of frontier areas offshore that could hold substantial deposits of petroleum, including oil. Encouraging further exploration in these areas could see the discovery and development of resources the size of those in the Bass Strait or Australia's major gas fields.

In the 2004–05 Budget, the government improved the PRRT system to provide a 150 per cent deduction for pre-appraisal exploration costs in frontier areas designated by the Minister for Industry, Tourism and Resources. The deductions will be claimable against all PRRT liabilities. This measure will significantly increase the incentives for petroleum exploration in frontier areas.

Figure 3: Map of Australia's offshore frontier basins



Source: Geoscience Australia 2004

EXPANDING OUR DEVELOPMENT HORIZONS—PETROLEUM IN FRONTIER AREAS

Australia's offshore area is much larger than its land surface, and may contain vast oil and gas reserves. More than half of Australia's offshore basins that show signs of petroleum potential remain unexplored, reflecting the cost and high-risk nature of exploration in frontier areas. To encourage petroleum exploration in these areas, the Australian Government has increased the value of exploration deductions in designated frontier areas from 100 per cent to 150 per cent when determining liability for Petroleum Resource Rent Tax. This provides an added incentive for exploration in those areas where a major new oil or gas province could be found.

The government will also seek to attract investment in the efficient discovery and development of our energy resources by:

- improving land access approval processes to maintain our world-leading position as a low-risk investment destination
- working with the state and territory governments to ensure that Australia maintains its world-class provision of pre-competitive geoscience data
- ensuring that greenhouse gas emission requirements for new energy projects are commensurate with those imposed on other sectors of the Australian economy
- requiring that the proponents of new, large greenhouse gas-emitting energy projects join the Greenhouse Challenge programme to ensure they actively manage their emissions

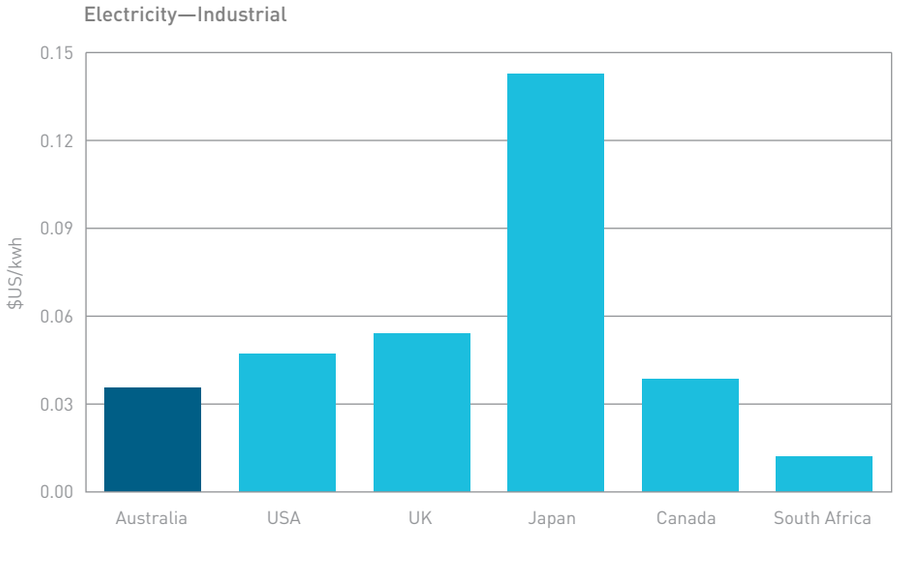
EFFICIENT AND EFFECTIVE ENERGY MARKETS

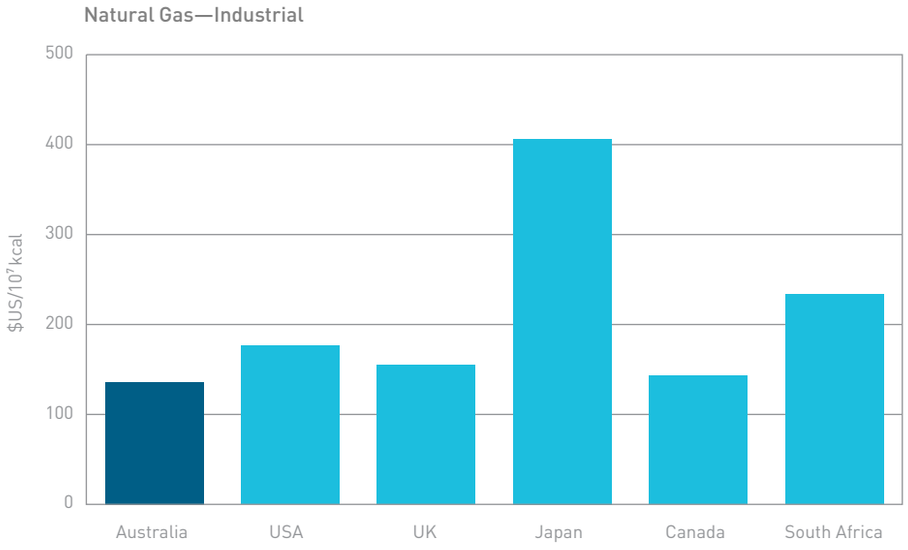
Efficient and effective energy markets are a key to achieving prosperity, reliability and sustainability from energy. Market reforms that encourage energy users to better manage demand, for example, will help deliver both economic and environmental gains. Reforms that facilitate more efficient transmission and distribution investment have the potential to improve reliability and maintain downward pressure on average energy prices. In transport energy, markets that provide access to competitive supplies of imported products are important—placing downward pressure on domestic prices and ensuring overall supply reliability.

Stationary energy

Australia enjoys some of the lowest stationary energy prices in the developed world. These prices have been an important factor in Australia's national prosperity, underpinning energy-intensive industry and providing cheap reliable energy to businesses and households.

Figure 4: Comparison of Industrial Energy Prices, 4th Quarter 2002





Source: International Energy Agency, Key World Statistics 2003

Demand for stationary energy services is projected to grow by at least 50 per cent over the period to 2020. The energy industry has estimated that at least $37 billion in energy investments will be required by 2020 to meet Australia's future energy needs. How efficiently and effectively Australia meets this future demand will play a key role in determining future prosperity, security and sustainability of energy production and use. Market signals are needed to ensure that the right investments are made in the right places at the right times.

Market reforms over the last decade, led by the Australian Government, including the formation of the National Electricity Market in 1998, have delivered significant benefits, adding $1.5 billion a year to the economy as a whole from lower prices, better investments and the flow-on benefits of these to the competitiveness of Australian industries.

Substantial work remains. The National Electricity Market is still largely a series of regional markets with limited interconnection, and the gas market is immature. Investment signals are weak in a number of important areas, like demand side participation. Reforms to address these issues are needed urgently to provide better signals for investors.

The Council of Australian Governments committed to a renewed programme of reform in December 2003 for the period to 2006. As a first step, a single energy regulator—the Australian Energy Regulator—and a single rule-making and market development body—the Australian Energy Market Commission—will be established. These institutions will replace 17 existing bodies and provide certainty and stability to energy markets. The next areas for reform are transmission planning, energy user participation, and removal of impediments to natural gas use. Transmission reforms are to be advanced by a national planning regime, underpinned by the Annual National Transmission Statement to improve interconnector development. The first such statement is expected in July 2004.

Opportunities exist to economise on infrastructure development through decentralising energy systems. To explore these opportunities, the Australian Government will provide $75 million to support Solar Cities trials. The trials will be designed to test innovative approaches to energy markets that deliver more effective signals to energy users and demonstrate how decentralised energy systems can deliver savings to households and business through reduced distribution and peak generation needs. Solar energy is especially suitable for these trials, given its output is highest at times of peak energy demand, when energy costs are highest.

SOLAR CITIES—A VISION OF THE FUTURE

The Australian Government will provide $75 million to support Solar Cities trials. The trials will provide a critical mass of local penetration of solar energy technologies in urban locations with Australian government support. Assistance to improve energy efficiency in commercial and residential buildings will also be provided. The trials will be designed to test innovative approaches to energy markets that deliver more effective signals to energy users.

These world-first trials will demonstrate how decentralised energy systems can deliver savings to households and business through reduced distribution and peak generation needs. Modern metering technology will be installed, allowing the trials' impacts to be carefully analysed. Solar energy is especially suitable for these trials, given its output is highest at times of peak energy demand when energy costs are highest. The trials will be undertaken with the cooperation of industry, state, territory and local governments to improve planning and design, deploy technologies and allow effective responses to market signals.

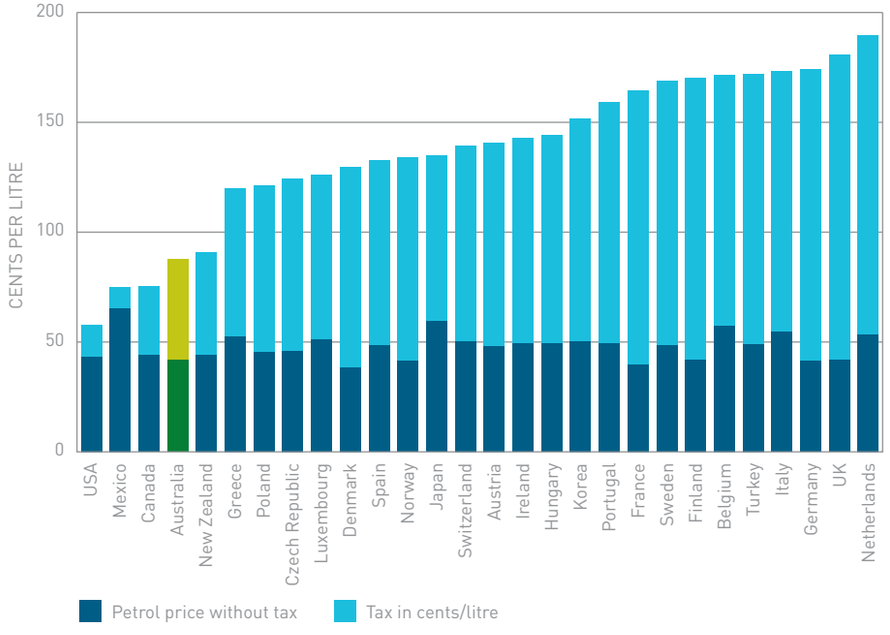
The Australian Government is committed to a long-term national leadership role in ongoing energy market reform. The government will continue to work collaboratively with the states and territories to develop an open, efficient and competitive market that is attractive to investors and provides competitive prices for users.

Transport energy

Australia's large transport task reflects our size, the distance between our cities, and dispersed production of goods. Transport accounts for 41 per cent of total final energy consumption in Australia, and demand for transport energy is growing at 2.4 per cent a year.

Meeting the nation's growing demand for transport energy effectively and efficiently is a key priority. Australian fuel prices are amongst the lowest in the Organisation for Economic Cooperation and Development (OECD) due in large part to our low fuel taxes. Australian petrol taxes are the fourth lowest in the OECD—diesel taxes are the fifth lowest. This is an advantage the government is determined to maintain. The government's 2001 decision to lower excise and abolish indexation will provide increasing benefits to fuel users into the future.

Figure 5: Petrol Prices in OECD Countries including tax, December Quarter 2003



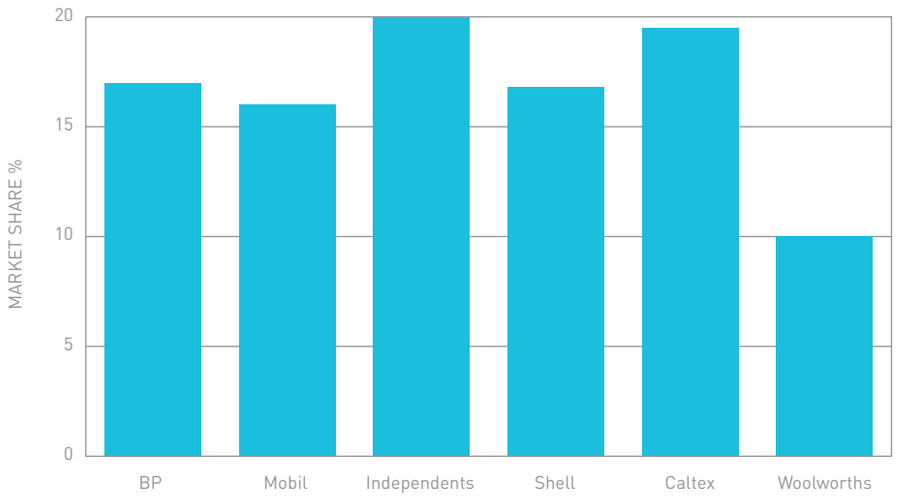
Source: International Energy Agency, 2004

Petrol and diesel meet more than 93 per cent of Australia's road transport needs. This dominance will continue until alternative fuels provide the same advantages in price and functionality. The Australian Government is providing generous support for alternative fuels, including the provision of substantial ongoing excise discounts, but will not mandate the use of these fuels. Growth in these fuels is coming off a very low base, and government policy must necessarily focus on the role of petrol and diesel in meeting future demand for transport fuels, and achieving environmental objectives.

Australia's petroleum refining industry can supply nearly all our transport fuel needs. The industry operates in an internationally competitive market, with large-scale refining capacity in Asia capable of exporting substantial volumes of fuel into Australia. This plays an important role in delivering competitive fuel prices to Australians.

Like many industries, the domestic refinery sector has undergone a period of significant structural change—with three refineries closing in the past 20 years. Margins in the industry have improved recently, in line with those in Asia due to increased world demand. The retail sector is also undergoing a period of structural change—with a move to larger, multi-purpose sites which sell a range of products. The introduction of Woolworths and Coles into the market has enhanced competition to the benefit of consumers and will play a major role in determining the future shape of fuel retailing in Australia. New arrangements between these companies and existing refiner/marketers will change the dynamics of the market further.

Figure 6: Retail Market Shares 2003



Note: 2003 data which predates market changes over the last 12 months
Source: IBIS World Australia, Automotive fuel retailing in Australia, 2004

These changes emphasise the importance of market arrangements which facilitate full and fair competition within the sector. Current arrangements governing the relationship between fuel wholesalers and retailers are overly prescriptive and, in the interests of consumers, a good case for reform exists. The Australian Government has developed a plan for reform, which is currently before the industry. The government looks forward to broad industry support for reform emerging.

FUEL EXCISE REFORM

The Australian Government will implement a complete overhaul of the fuel excise system to lower costs for many thousands of businesses and households, and remove fuel excise from most business inputs. The compliance burden will be reduced for all businesses that claim excise credits, and the partial excise paid on fuel used in heavy vehicles will be converted to a road user charge. Excise credits will apply to all fuels. By 2012–13, the reforms will have removed about $1.5 billion in excise off business and households. The result will be an excise system better suited to the needs of the new century.

REDUCING THE BURDEN OF TAXATION—FUEL EXCISE REFORM

Starting on 1 July 2006 and concluding on 1 July 2015, the fuel excise system will be modernised and simplified. About $1.5 billion in excise liability will be removed during the period to 2012–13 benefiting many thousands of businesses and households. The government will limit the effective application of excise to the business use of fuel in on-road applications in vehicles with a gross vehicle mass of less than 4.5 tonnes, and private use of fuel in on-road vehicles and certain off-road applications. All fuels used off road for all business purposes will become effectively excise free.

Excise on burner fuels will be removed, benefiting up to 90 000 households, mainly in regional areas, that currently pay excise on the fuel they use for heating. The current partial excise on fuels used in heavy vehicles will be converted to a road user charge and the existing urban-rural boundaries will be abolished. The excise arrangements for heavy vehicles will apply to all fuels, not just diesel. This will provide partial excise relief for around 54 000 heavy petrol vehicles for the first time [ABS 2003]. These changes build on the 2003–04 Budget decision that excise rates for all fuels will be based on energy content. Alternative fuels that effectively enter the excise net from 1 July 2011 will receive a 50 percent discount on energy content based excise rates.

Fuel excise rates will be based on energy content rather than volume. Excise will apply to all fuels used in road transport, with alternative fuels receiving an ongoing excise discount of 50 per cent. Alternative fuels will remain effectively free of excise until 1 July 2011. Effective excise will then be increased in five equal annual steps to the new discounted rate on 1 July 2015. These arrangements provide a generous transition path that allows existing industries (such as the liquefied petroleum gas (LPG) industry) time to adjust, and new fuels (such as biofuels and compressed natural gas (CNG)) time to establish themselves in the competitive marketplace.

Table 2: Excise rates

Fuel type	Energy content (megajoules/litre)	Excise rate (cents/litre)	Discount rate
High-energy content fuels: petrol, diesel, gas to liquids, diesel, biodiesel	Above 30	38.143	19.1 (biodiesel)
Mid-energy content fuels: liquefied petroleum gas, liquefied natural gas, ethanol, dimethyl ether	Between 20 and 30	25.0	12.5 (all)
Low-energy content fuels: methanol	Below 20	17.0	8.5 (methanol)
Other: compressed natural gas	Between 38 and 41 (megajoules/ cubic metre)	38.0 (cents/cubic metre)	19.0 (cents/cubic metre)

The current complex system of providing excise credits, rebates, subsidies and grants will be replaced with a new approach commencing on 1 July 2006. These reforms will narrow the scope of excise to: business use of fuels in on-road applications in vehicles with a gross vehicle mass (GVM) of less than 4.5 tonnes, and private use of fuel in on-road vehicles and certain off-road applications. The 4.5-tonne GVM cut-off was chosen because it reflects an existing break point in the fuel taxation system; additional licensing conditions must be met in all Australian jurisdictions to drive a vehicle of this mass or greater; and it is more difficult to distinguish between private and business use in small vehicles. The changes will provide competitive neutrality across businesses, and allow credits for all fuels. This alone will provide excise relief for fuel used in around 54 000 heavy petrol vehicles (ABS 2003).

The existing partial excise paid on diesel used in heavy vehicles will be converted to a road user charge from 1 July 2006. The level of the charge will be adjusted annually using the same formula used by the states and territories to set and adjust registration charges. This approach responds to long-made calls by the transport industry for government to adopt a road user charge. The charge will apply from 1 July 2006. These changes will coincide with removal of existing urban–rural boundaries applying to heavy vehicles for the receipt of energy credits, removing a source of frustration and cost for the trucking industry. New, more effective and less burdensome measures, will be introduced to deliver the environmental objectives underlying the boundaries.

The changes to arrangements for heavy vehicles complement the government's substantial increase in land transport investment. The government is allocating $11.8 billion for road and rail transport over the five years to 2008–09. The major components of this funding include:

- $7.7 billion in land transport funding for the AusLink National Network
- $1.45 billion for the Roads to Recovery programme
- $2.55 billion of Financial Assistance Grants for roads
- $90 million for the National Black Spot programme.

All business use of fuels in off-road applications will enjoy an effective excise rate of zero from 1 July 2012. This will reduce costs for a large range of industries, and many thousands of individual businesses. The expansion of excise credits to deliver this zero excise rate for newly eligible activities will be phased in commencing 1 July 2008.

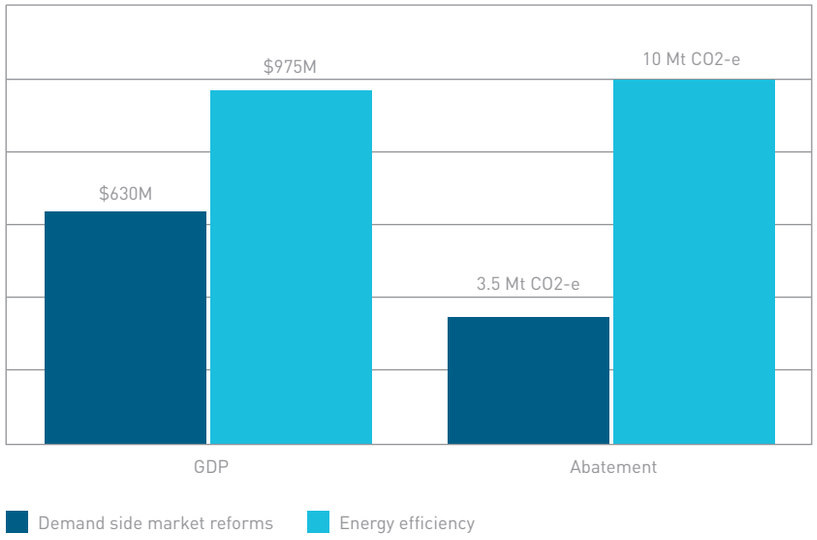
Excise paid on fuels used in power generation will be effectively removed from 1 July 2006. Excise paid on burner fuels (such as heating oil) will also be removed, benefiting up to 90 000 households who rely on this form of energy for heating. These changes will place users of these fuels in the same competitive position as users of other energy sources, such as coal-based electricity or natural gas.

To further reduce the compliance burden, the existing system of excise credits and rebates will be replaced by a single system of business credits, which will be administered through businesses' existing Business Activity Statements.

ENERGY EFFICIENCY

Improving Australia's energy efficiency performance is a key part of the government's plans to deliver prosperity and sustainability from energy. Increasing the uptake of commercially attractive energy efficiency opportunities would deliver substantial economic and environmental benefits. Estimates complied for the National Framework for Energy Efficiency process show that implementing half of all energy efficiency opportunities with a payback of four years or less could, if commercial, increase GDP by $975 million a year and reduce greenhouse emissions by around 10 million tonnes a year. This compares with projected GDP benefits of $630 million a year from reforms in the energy market to encourage better demand management from energy users.

Figure 7: Economic and environmental gains from demand side management and energy efficiency



Note: The gains above would not be fully additive
Source: COAG Energy Market Review, modelling conducted for the Ministerial Council on Energy

The government will implement a range of measures to pursue these gains. Energy market reforms being pursued through the Ministerial Council on Energy and demonstrated through the government' Solar Cities trials (see Box Solar cities—A vision of the future) will encourage a greater focus on energy efficiency. However, improved market arrangements are not, of themselves, sufficient.

Figure 8: Energy efficiency potential

Source: Data prepared for the Ministerial Council on Energy's National Framework on Energy Efficiency see NFEE (2004).

Market reforms will be complemented by a detailed suite of measures designed to increase the uptake of commercial opportunities to improve energy efficiency. Measures announced in the 2004–05 Budget target domestic and commercial energy users by expanding and extending minimum energy performance standards for appliances and buildings, and improved vehicle efficiency. The government will also take a lead by further improving its own operations.

These measures will be supplemented by new requirements for the very largest energy users. Firms using more than 0.5 petajoules of energy a year (equal to the energy needs of around 10 000 households) will be required to undertake energy efficiency opportunity assessments every five years. These assessments will be conducted in accordance with strict standards, and firms will be required to report publicly on the outcomes. Commercial judgements by firms will determine whether investments are pursued.

IMPROVING PRODUCTIVITY—ENERGY EFFICIENCY OPPORTUNITY ASSESSMENTS

More efficient use of energy in Australia could yield a $975 million improvement in GDP each year. Around 250 large energy users (those businesses using more than 0.5 petajoules of energy per year) account for more than 60 per cent of total business energy use. The Australian Government will require these companies to undertake a detailed review every five years to identify energy efficiency opportunities. The results of the opportunity assessments will be reported publicly. This approach ensures that all large energy users will be able to demonstrate to the community that they are efficiently managing their energy, without the government becoming involved in commercial decisions. The government will act to ensure assessments are rigorous and comprehensive, and to disseminate lessons learned to the wider business community.

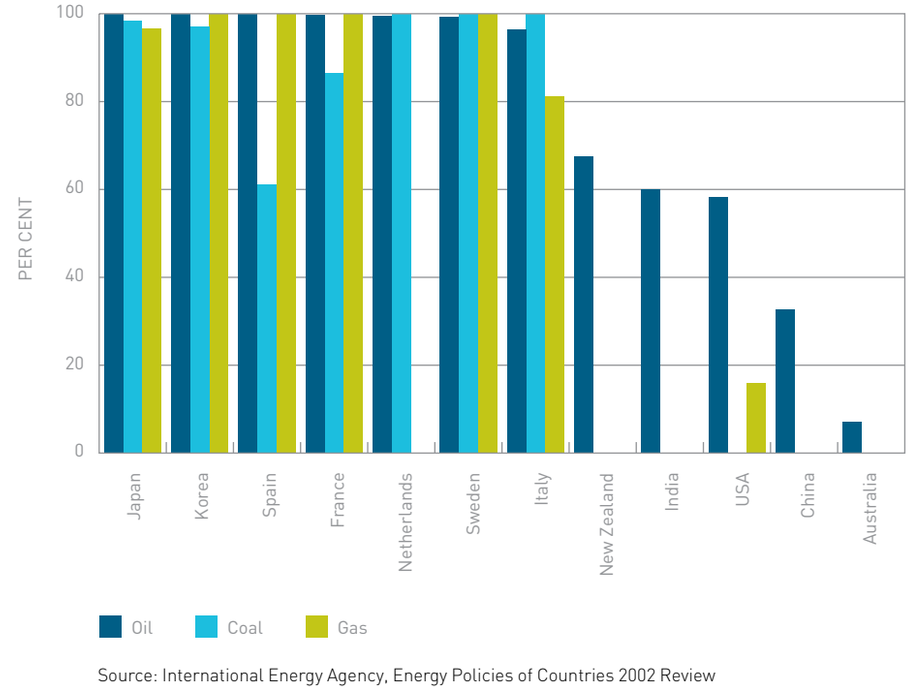
PROVIDING ENERGY SECURITY

Australia enjoys a very high level of energy security. But this cannot be taken for granted. Blackouts in North America and Italy and, at home, blackouts in Western Australia, the Moomba gas fire plant, and the threat of terrorist action are all timely reminders of this.

Access to resources

Australia's access to domestic energy resources is amongst the best in the developed world. Australia has sufficient stationary energy sources to meet its electricity and heating needs for hundreds of years, significant petroleum resources, and good access to imported petroleum products.

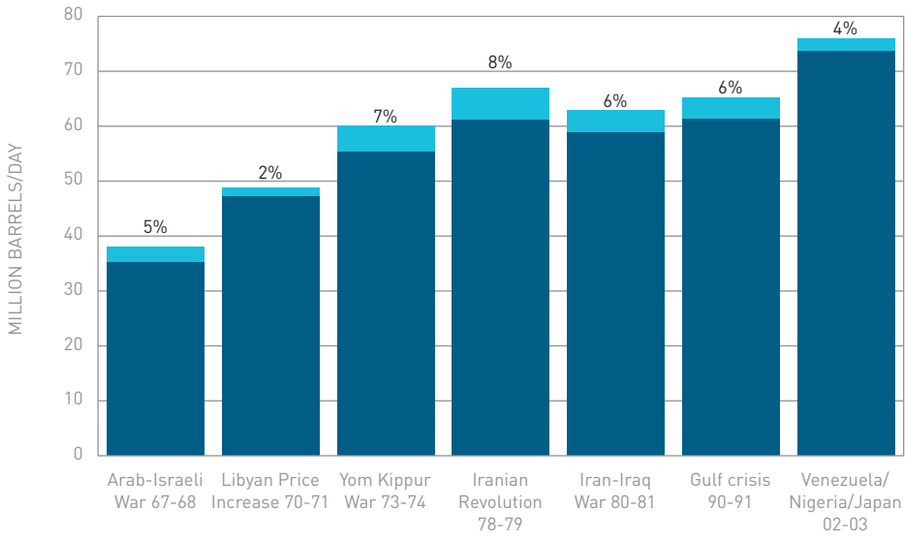
Figure 9: Net import dependency in 2000 for crude oil, coal and natural gas



Source: International Energy Agency, Energy Policies of Countries 2002 Review

Concern about energy security often centres around world reliance on oil from the Middle East. While world reliance on oil from the Middle East is increasing, this needs to be placed into context. Past disruptions in Middle Eastern supplies have had a relatively small impact on global oil flows and almost no impact on Australia's ability to source oil and refined transport fuels. Like other countries, Australia has had to face price increases, but supplies have been maintained.

Figure 10: World oil supply disruptions



Note: Short fall in supply shown as percentage of pre-disruption world supply.
Source: International Energy Agency and Australian Government Estimates

Australia is in the position of having access to potentially large reserves of alternative fuels, such as biofuels, or conventional fuels from new sources such as shale or natural gas. However, these fuels are more expensive than oil-derived petrol and diesel, and technical impediments exist to the widespread use of some alternative fuels. Pursuing these fuels now as a large-scale replacement for oil-derived petrol and diesel, even given currently high oil prices, would weaken Australia's competitiveness and potentially weaken its energy security position. The existence of these resources and of investors seeking to develop them gives substantial comfort that Australia will be well-placed to respond should world oil prices increase substantially in the longer term.

Infrastructure

Australia has high-quality infrastructure for converting resources into the energy products used by households and industry. The Australian Government will, however, continue to pursue market reform vigorously because past market arrangements for electricity and gas have resulted in relatively weak interconnections between states. Further market reform provides the key to ensure appropriate links are established. The advent of the South-East Australia (SEA) Gas pipeline supplying South Australia from Victoria, for example, significantly reduced the potential impact in South Australia of the Moomba disruption in early 2004. The connection of Tasmania's electricity system, through Basslink, to the mainland by the end of 2005 will also strengthen the reliability of electricity supplies in the National Electricity Market.

In the transport sector, changes in Australia's refinery sector are increasing its reliance on imports of refined transport fuels, as well as crude oil. This trend does not currently pose an energy security concern for Australia. Substantial reductions in refinery capacity would increase the risk, and the government will keep this situation under review but will not support uneconomic refinery investment.

Response to disruptions

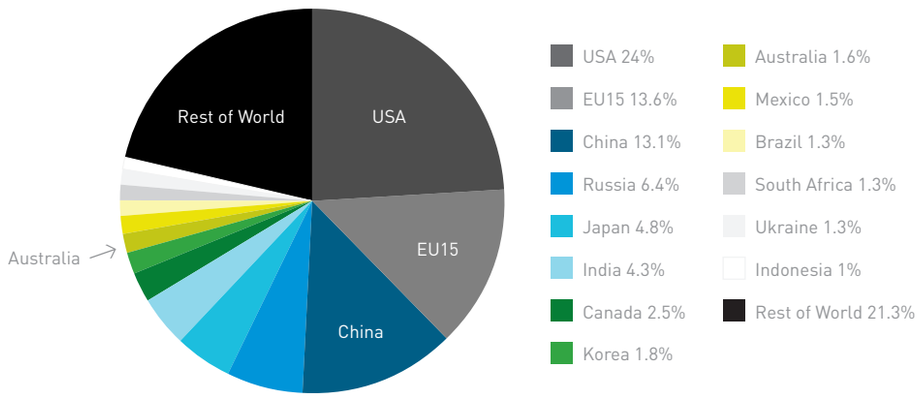
Australia has in place strong mechanisms to respond to disruptions to energy supplies. Internationally, Australia is an active member of the International Energy Agency, which has specific protocols to address a major international disruption to oil supplies. Domestically, the Liquid Fuels Emergency Response Plan has been developed with the states and territories. Given the importance of energy security the Australian Government is further enhancing the country's capacity to respond to disruptions. Arrangements through the Critical Infrastructure Advisory Council are being developed to protect key energy assets from the threat of intentional disruptions and implement tested recovery procedures supported by an additional $4 million from the 2004–05 Budget. The Ministerial Council on Energy is currently developing emergency response protocols for the gas sector, including the interaction between electricity and gas. The government will also conduct a review of the Liquid Fuels Emergency Act 1984.

ENERGY AND CLIMATE CHANGE

Addressing human-induced climate change is a major issue for this century. Emissions of greenhouse gases have the potential to raise global temperatures, resulting in deleterious effects to people and the natural world, its land and seascapes, its flora and fauna. Substantial reductions in global greenhouse emissions will be needed to avoid these effects.

Energy production and use is the major source of greenhouse emissions globally and in Australia. Energy accounts for 68 per cent of national emissions and this percentage is rising. Energy sector emissions must be reduced as part of any effective global climate change response.

Figure 11: Shares of global energy based CO_2 emissions, 2001



Source: International Energy Agency

Although Australian greenhouse gas emissions are about 1.6 per cent of world emissions and are too small for Australia to make a difference on its own, Australia is committed to pursuing an effective global response to climate change. To be effective, a global response must encompass the world's largest emitters and address the issue of economic activity and emissions potentially moving from one nation to another with no overall global greenhouse gas emission reduction.

Australia has shown strong leadership on greenhouse through its own actions, and is on track to meet its Kyoto target of 108 per cent of 1990 emission levels by 2008–12. This has been achieved while maintaining a vibrant energy sector and a prosperous economy. The Australian economy grew by 47 per cent between 1990 and 2002. Over the same period, greenhouse emissions grew by 1.3 per cent.

The Australian Government has allocated over $1 billion to a comprehensive approach to greenhouse abatement focussed on the Kyoto period, including a range of programmes to promote energy efficiency, development and uptake of lower-emissions technologies, reductions in transport emissions, and non-energy abatement. Globally, the exploitation and export of Australia's energy resources, such as liquefied natural gas (LNG) and uranium, are reducing the need for higher greenhouse gas emission energy sources in other countries.

The Australian Government continues to support the underlying objectives of the UN Framework Convention on Climate Change but remains convinced that ratification of the Kyoto Protocol is not in the national interest. The Kyoto Protocol does not provide the basis for an effective long-term response as it does not include all of the largest emitters in the world, nor does it include a pathway for addressing developing countries, whose emissions will soon overtake those of industrialised countries.

In pursuing an effective global response for the longer term Australia will continue to deliver a prosperous economy with a lower greenhouse signature. The Australian Government will continue to meet it's greenhouse objectives while underpinning the value of existing resources, and maintaining competitiveness.

The government's climate change strategy for the Kyoto period and beyond builds on the success of its current climate change programme and will focus and integrate measures in five strategic areas:

- positioning Australia to further reduce its greenhouse signature as the economy continues to grow strongly
- engaging internationally to contribute to developing an effective global response to climate change
- addressing the risks, capturing the opportunities and preparing Australia for the impacts of climate change
- building our understanding of the science of climate change and our capacity to measure greenhouse emission trends accurately
- advancing whole of government policy making in this area.

Australia will not impose significant new economy-wide costs, such as emissions trading, in its greenhouse response at this stage. Such action is premature, in the absence of effective longer-term global action on climate change, and given Australia is on track to meet its Kyoto 108 per cent target. Pursuing this path in advance of an effective global response would harm Australia's competitiveness and growth with no certain global climate change benefits.

Whatever the future shape of international action on climate change, it is prudent for Australia to take practical action now to prepare our economy and society for the future. Waiting for an effective global response before taking any further action is not an option. The size of greenhouse reductions that may be needed over the long term demands that a strategy be introduced to prepare the economy to respond to any future emissions constraints. The time taken to develop and introduce new technologies, and the long life of energy infrastructure also mean that even long-term objectives can be affected by near-term decisions.

BUILDING OUR FUTURE—LOW EMISSIONS TECHNOLOGY DEVELOPMENT FUND

The Australian Government will establish a $500 million Low Emissions Technology Fund supporting industry-led projects to demonstrate the commercial viability of new energy technologies with low greenhouse gas emissions. These technologies will be needed to reduce the cost of meeting any future greenhouse constraint. Using hot dry rocks, solar power, wind, waves or tides to generate electricity, capturing and storing carbon emissions, better traffic management and a range of other developing technologies all offer potential for long-term greenhouse gas abatement. Technologies eligible for the fund will have the potential to lower Australia's emissions by at least 2 per cent in the long term at a realistic uptake rate, and be commercially available by 2020 to 2030. The fund is designed to leverage at least $1 billion dollars in private sector investment. This will create a world-scale, world-leading partnership for developing the technologies that can secure a sustainable future.

The Australian Government will implement a suite of measures to lower the cost of significantly reducing greenhouse emissions in the future by:

- increasing the availability and reducing the costs of low greenhouse emissions technologies by
  - establishing a $500 million fund to demonstrate low-emission (fossil fuel and renewable) technologies which could significantly reduce greenhouse gas emissions if deployed at commercial scale
  - providing an additional $100 million to target strategic research, development and commercialisation of smaller-scale renewable energy technologies
- establishing a $75 million Solar Cities programme to provide a working demonstration of how technology, energy efficiency and efficient markets can combine to provide a sustainable energy future
- facilitating commercially attractive emission reductions, with a focus on large energy users, through measures including mandatory energy efficiency opportunity assessments, an enhanced Greenhouse Challenge programme with membership required for large energy projects and users, and development of more demand side management opportunities in electricity and gas markets
- maintaining support for the takeup of low-emission energy sources, including by
  - continuing the Mandatory Renewable Energy Target (MRET) until 2020 with improved transparency and administration
  - providing $230 million to continue support for greenhouse technology projects under programmes such as the Remote Renewable Power Generation and Greenhouse Gas Abatement programmes.
  - providing $34 million to remove specific barriers to the deployment of renewable energy, including better wind forecasting, improved electricity storage options and better grid connection rules.

The strategy outlined above delivers on current commitments and more importantly prepares Australia to respond to any potential long-term emissions constraints. It does this while maintaining the nation's economic prosperity and placing Australia at the cutting edge of low-emission technologies. It also sets a clear policy framework that allows business to manage risk.

Australia will actively work with other countries in developing an effective global approach to dealing with the greenhouse challenge but will not impose substantial economic costs, such as through the introduction of emissions trading, in advance of an effective global response emerging. Should such a response emerge, the government would need to consider least cost approaches to constraining emissions.

ENERGY AND THE ENVIRONMENT

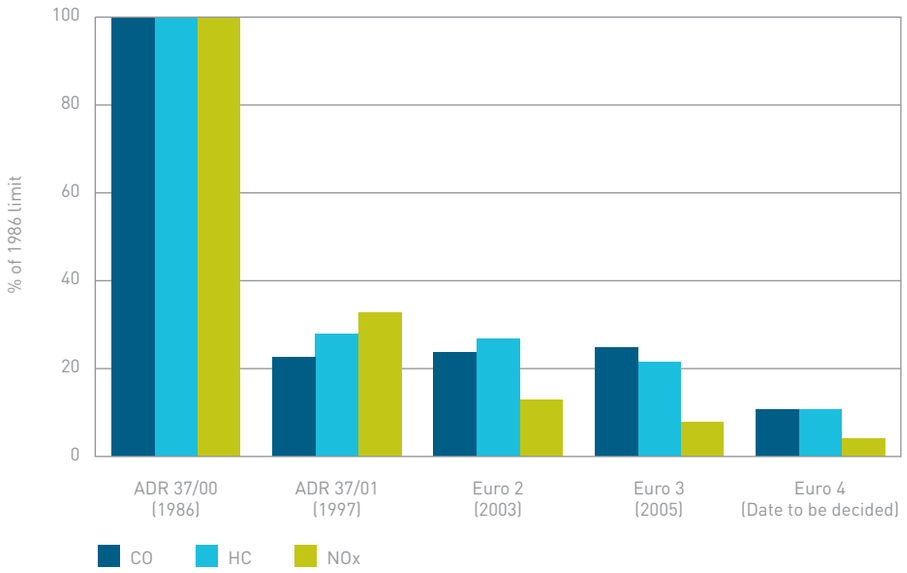
Air pollution and the impact of energy developments on land and water are significant. The Australian and state governments share responsibility for these issues. For its part the Australian Government focuses on two aspects—air quality in the transport sector and the impact of major projects.

Australia enjoys a high level of air quality by international standards, with problems being confined to specific locations for relatively short periods of time. Addressing these is important, given the link between air quality and a range of serious health problems. Emissions from motor vehicles are a major contributor to air pollution.

Limiting the level of air pollution has been a major focus of government policy. Clear long-term standards have been set under the Air Quality National Environment Protection Measure and form the basis of policy settings by the Australian and state governments.

Australia is progressively tightening fuel standards to improve emissions and facilitate the introduction of new, more efficient engine technologies. At the end of this process, Australian fuel will be amongst the cleanest in the world. Pursuing better fuel standards will avoid health costs of $3.4 billion by 2020. Decisions on future standards will continue to be informed by a detailed assessment of the health and air quality benefits of clean fuels and the impact of new fuel standards on competition, including the reliability and cost of imported fuel supplies.

Figure 12: Timing and magnitude of reductions in emission standards for new passenger vehicles



Vehicle technologies also play a critical part in the emission equation. The Australian Government has in place a programme for improving vehicle emission standards and has agreed with industry to reduce the average fuel consumption of new vehicles sold in Australia from 8.43 litres per 100 kilometres to 6.8 litres per 100 kilometres in the period to 2010. Better information will also be provided to consumers through the use of fuel consumption labels, and the Green Vehicle Guide. As part of its AusLink strategy, the Australian Government will also work with state governments to identify and trial techniques for reducing congestion in Australian cities.

BUSINESS AND GOVERNMENTS—PARTNERS FOR THE FUTURE

A prosperous and sustainable economy needs all participants to play a part. The Australian Government expects businesses, especially large energy users, to play an active role in making the country's future better.

From 1 July 2006, businesses receiving fuel excise credits of more than $3 million will be required to monitor and manage their greenhouse emissions as members of the Greenhouse Challenge programme. Proponents of energy resource development projects above specified projected emission levels will also be required to participate in the Greenhouse Challenge.

The Australian Government will also require the 250 largest energy users in Australia, those using more than 0.5 petajoules of energy per year, to undertake energy efficiency assessments every five years and publicly report on the outcomes.

Government support for technology development, including the $500 million Low Emissions Technology Fund, will leverage at least $1 billion of industry investment in low-emission technology development and demonstration.

Government cannot build a sustainable future on its own. Business has an obligation to manage its emissions well. These measures require this obligation to be met, while allowing business to pursue the commercial opportunities needed to deliver a prosperous economy.

Australian Government approval processes provide a streamlined and efficient mechanism to ensure nationally significant environmental values are protected while economic development occurs. The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) covers matters of national environmental significance: world heritage properties, national heritage places, Ramsar wetlands of international importance, nationally threatened animal and plant species and ecological communities, internationally protected migratory species, Commonwealth marine areas, and nuclear actions. The EPBC Act provides for streamlined, transparent and efficient environment assessments and approvals. The government engages with industry in developing guidelines and practices that ensure effective environmental management while reducing the need for complex processes.

DEVELOPING TECHNOLOGY

Innovation and the introduction of new technologies will play a key role in creating an energy sector that delivers prosperity, security and sustainability into the future. Domestic and global advances in energy technology are reducing the cost of producing and using energy with lower emissions. Improvements in transport technologies are bringing fuel consumption and emissions down for users. Longer term, there is potential for using technologies like hydrogen to deliver abundant low-emissions energy.

The Australian Government provides substantial support for innovation across all sectors, including the energy sector. Through Backing Australia's Ability: Building our future through science and innovation, a further $5.3 billion will be provided for science and innovation over the next seven years. This represents the single largest investment in science and innovation in Australia's history. Combined with other science and innovation programmes, this takes the Australian Government's ten-year investment in this key area to around $52 billion.

The government has in place substantial support for energy sector innovation. In 2001–02, the government spent $223 million on energy innovation—including nearly 5 per cent of the research and development budget for that year. Government regulations, including the Mandatory Renewable Energy Target, Minimum Energy Performance Standards, and excise exemptions for alternative fuels, also encourage the uptake of technology. The National Research Priority Goal has been established for 'reducing and capturing emissions in transport and energy generation'. The CSIRO has established Energy Transformed as one of its seven flagship programmes and received significant additional funding in the 2004–05 Budget. Research centres , funded through the Australian Research Council and other renewable research, include the Key Centre for Photovoltaic Engineering at the University of NSW. Cooperative Research Centres exist for low-rank coal, black coal and geosequestration. Support for innovative energy-related projects has also been provided through the Strategic Investment Coordination process.

RENEWABLE ENERGY

Renewable energy will play an important part in Australia's long-term greenhouse response, and the Australian Government will continue its extensive and effective support for these technologies. The Mandatory Renewable Energy Target will continue to 2020, providing incentives for over $2 billion in renewable energy investment. Renewable energy will also continue to be an important focus of Australia's innovation effort, including through national research priorities and CSIRO's Energy Transformed flagship.

In addition, the Australian Government will provide $134 million to address specific barriers impeding the uptake of renewable energy:

- $100 million over seven years, comprising $50 million new funding and $50 million from the Commercial Ready Programme, will be allocated to promote strategic development of renewable energy technologies, systems and processes that have commercial potential.
- $20 million will be provided to support development of advanced electricity storage technologies, including batteries, electro-mechanical and chemical storage. Important renewable energy technologies, including wind and solar, produce electricity intermittently, which can reduce their attractiveness and ability to contribute to the electricity system. Breakthroughs in storage could rapidly accelerate renewable energy use, and Australia has technological leadership in some storage technologies.
- $14 million will be used to develop and install systems to provide accurate long-range forecasts for wind output. This will facilitate greater penetration of wind in energy markets and allow for more strategic planning of new wind farms.

In addition to this funding dedicated specifically to renewable energy, the Australian Government is introducing significant new measures to promote low-emissions technology more generally.

- The new $500 million Low Emissions Technology Development Fund will provide support for demonstrating new low-emissions technologies with significant long-term abatement potential. This will include those renewable technologies that can demonstrate the potential for wide uptake.
- $75 million allocated to Solar Cities trials will directly support focused uptake of solar electricity and hot water as well as energy efficiency and efficient pricing signals. This will include trialing of more effective energy market signals.
- The Australian Government will also work with states and territories to identify and overcome energy market rules that provide impediments to the uptake of smaller-scale local generation (distributed generation), including renewable energy sources.
- $230 million was also included for the Australian Greenhouse Office to continue support for greenhouse technology projects under programmes such as the Remote Renewable Power Generation and Greenhouse Gas Abatement programmes.

Overall, the Australian Government has committed through this Energy White Paper and the 2004–05 Budget more than $700 million in new funding to low emission technologies, bringing its total commitment to almost $1 billion.

Australia's relatively small size in the global economy means it cannot be a leader in all technologies. An assessment of strategic interests identified the following broad categories of energy technologies:

- **market leaders—**technologies with strategic importance for Australia that international efforts will not adequately address, or in which Australia has a clear technology advantage
- **fast followers—**technologies where Australia has a strategic interest but where domestic efforts should focus on supplementing international developments, adapting technologies to suit Australian needs and, adopting these technologies quickly when available
- **reserve—**technologies in which Australia has a lesser strategic interest at this stage, but which may become more important in the future

Table 3: Technology assessments

Market leader	Fast follower	Reserve
Play a leading role in international R&D efforts.	Strongly position Australia to follow international developments quickly.	Position Australia to monitor international developments and follow as needed.
Energy supply technologies		
Advanced brown coal Geosequestration Hot dry rocks Photovoltaics Remote area power systems Coal mining and extraction	Advanced black coal Natural gas Wind Biomass Wave	Hydrogen Tidal Large-scale hydro Nuclear
Energy demand technologies		
Solid Oxide Fuel Cells	Intelligent transport systems Energy efficiency Advanced conventional vehicles Hybrid electric vehicles	Other fuel cells

These assessments provide a strategic backdrop when assessing innovation priorities for energy. They do not override the need for research excellence. As there are many individual components within technologies, niche opportunities in all areas of energy-related innovation will continue to be pursued.

The Australian Government will also continue to engage actively with the rest of the world, and the government will undertake a major review of these agreements with a view to identifying opportunities to better coordinate and strengthen our engagement with the international community.

LOOKING FORWARD

Although Australia's energy sector has delivered prosperity, security and sustainability, this cannot be taken for granted. To maintain this into the future, Australia must meet the challenge of implementing policies that ensure the right investments are made at the right time to develop the nation's resources, meet its energy needs and protect the environment.

The Australian Government, through the strategy in this Energy White Paper, and more broadly through its responsible approach to economic management, responds to that challenge by delivering a strong, practical and long-term strategy for energy in Australia. Under this strategy:

- Australia's energy resources will continue to be developed for the benefit of all Australians
- Australia's energy markets will be further reformed to ensure that they deliver reliable supplies of competitively priced energy
- high levels of energy security will be maintained and enhanced
- Australia's energy efficiency performance will be improved, delivering economic and environmental benefits

A balanced, practical approach will deliver on Australia's environmental responsibilities, while preparing the nation for a greenhouse-constrained future. Investment will be made to deliver the low-emission technologies needed to meet demand for energy and lower Australia's long-term greenhouse emissions signature.

The Australian Government will continue to engage internationally and with the states and territories to ensure Australia's economic, security and sustainability goals are delivered. In doing so, it will work towards an energy future where:

- Australia's energy resources continue to be developed for domestic and export markets providing prosperity and economic growth
- growing demand for energy by Australians and Australian businesses is met by reliable supplies of competitively priced low-emissions energy

The strategy in this Energy White Paper will secure Australia's energy future.

ENERGY IN AUSTRALIA

WHY IS ENERGY IMPORTANT?

Energy is a basic input into virtually every aspect of personal and business activity. Energy, in some form, is involved in most household activities, such as heating, cooling, cooking, lighting, transport or enjoying services or products that require energy in their supply. Firms also use energy in virtually all of their activities, whether it is processing and manufacturing materials, transporting goods, heating and cooling premises, providing telecommunication services or powering computers. As a result, energy is a fundamental part of life in Australia and the energy sector is an essential component of the Australian economy.

Expenditure on energy in Australia in 2002–03 was about $50 billion. Energy exports of coal, natural gas, oil, petroleum products and uranium amounted to $24.2 billion (ABARE 2004). Energy is a significant input for major industries such as aluminium, steel, cement, and pulp and paper; their international competitiveness relies on access to competitively priced, reliable energy. The energy sector directly employs about 120 000 Australians while energy-intensive industries employ hundreds of thousands more. The aluminium, cement and paper industries alone employ 35 000 Australians.

Energy production and use also has environmental impacts. Transport emissions are a source of urban air pollution. Energy development projects can lead to a range of impacts on air and water quality, biodiversity, noise levels and heritage. Energy use is also the major contributor to greenhouse gas emissions.

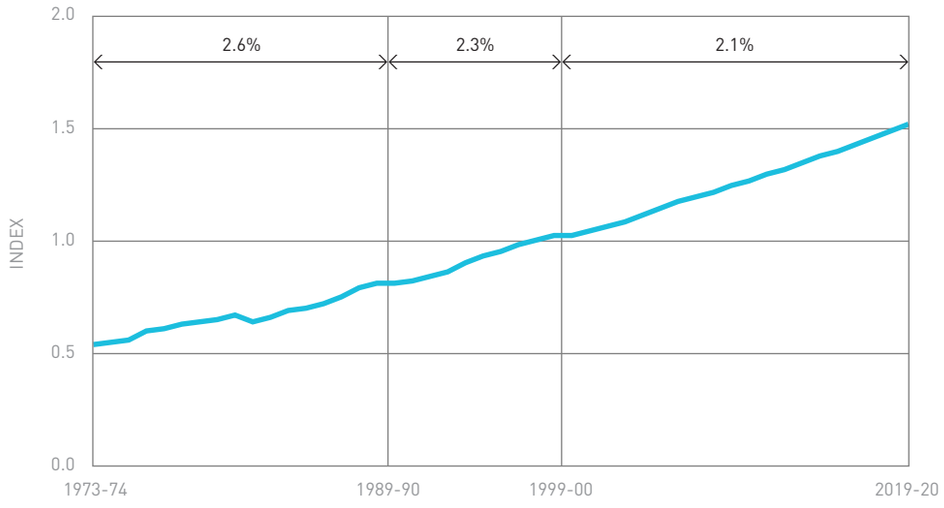
Given its fundamental importance to business and family life, the Australian Government's objective is to ensure that there is reliable access to competitively priced energy, the value of energy resources is optimised, and environmental issues are well managed. This Energy White Paper sets out a comprehensive and integrated approach to meeting the government's energy objectives of prosperity, security and sustainability.

AUSTRALIA'S ENERGY SECTOR

This introduction draws upon the June 2003 report of the Australian Bureau of Agricultural and Resource Economics (ABARE) to the Ministerial Council on Energy, Australian energy: National and state projections to 2019–20 (ABARE 2003). Total primary energy use is the total consumption of all forms of energy in both the conversion of one form of energy to another, such as the production of electricity, and by end use sectors such as government, business and households. Over the last 30 years, since 1973–74, total primary energy use in Australia grew by some 2.6 per cent per year, compared with economic growth of 3.2 per cent per year. In 2000–01 Australia's total primary energy consumption was 5037 petajoules (PJ)[1].

Total Australian primary energy consumption is projected by ABARE to grow at an average of 2.1 per cent over the period 2019–20, while gross domestic product is assumed by ABARE to grow by 3.4 per cent per year. Under these assumptions, total primary energy consumption would grow by 50 per cent to 2019–20, reaching 7515 PJ.

Figure 1: Australian primary energy consumption historical and projected



Source: ABARE Australian energy: National and state projections to 2019–20, 2003

1. 1 petajoule is approximately equal to the final energy consumption of 20 000 Australian households.

Primary energy use is the major determinant of energy-related greenhouse gas emissions, and provides the basis for analysing energy inputs, such as coal, oil, gas and renewables. Fossil fuels are Australia's major energy sources: oil, black coal, natural gas and brown coal provide 35, 28, 19 and 13 per cent respectively of primary energy needs. Renewable sources currently supply 5 per cent. Natural gas and renewables use for electricity will grow significantly.

While the use of wind and solar energy is expected to grow significantly over the next 20 years, it will do so from a very small base. Coal and oil will continue to be by far the most important primary energy sources. Uranium is not used as an energy source in Australia but is exported under stringent safeguard arrangements to ensure it is used for exclusively peaceful purposes and is fully accounted for throughout the nuclear fuel cycle.

Electricity demand has expanded strongly in the last 20 years by more than 4 per cent per year, and has doubled over the last two decades. Electricity generation is a major primary energy user, equal to around 40 per cent of total primary energy. Coal, which produced 78 per cent of electricity in 2000–01, will remain the main energy source for electricity generation despite substantial growth in natural gas and renewables.

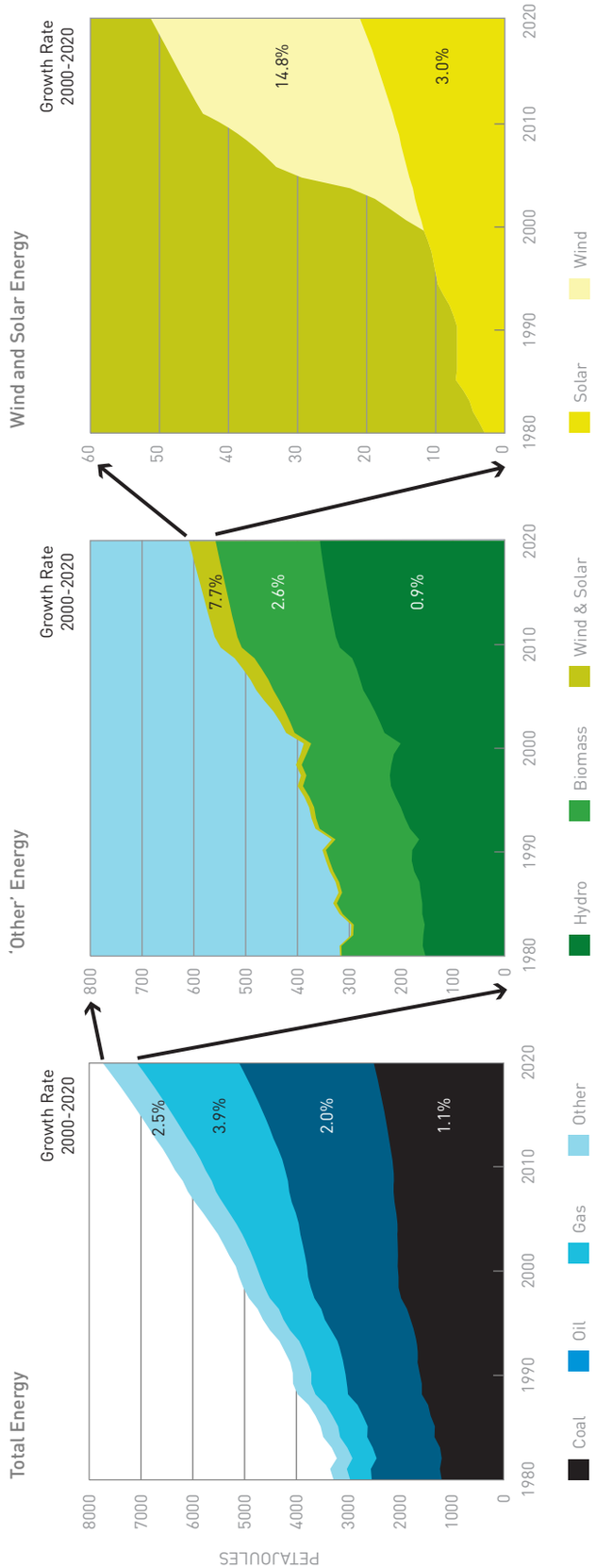
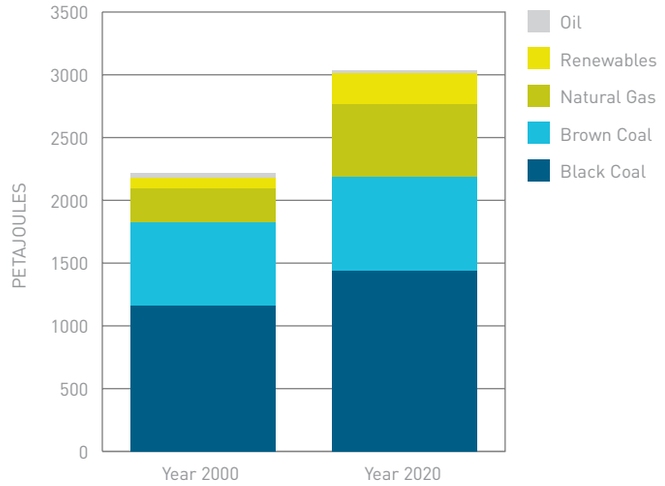


Figure 2: Composition of Australian energy supply

Source: ABARE FES data for 1980 to 2000 and Australian energy projections for 2001 to 2020

Figure 3: Energy inputs into electricity generation



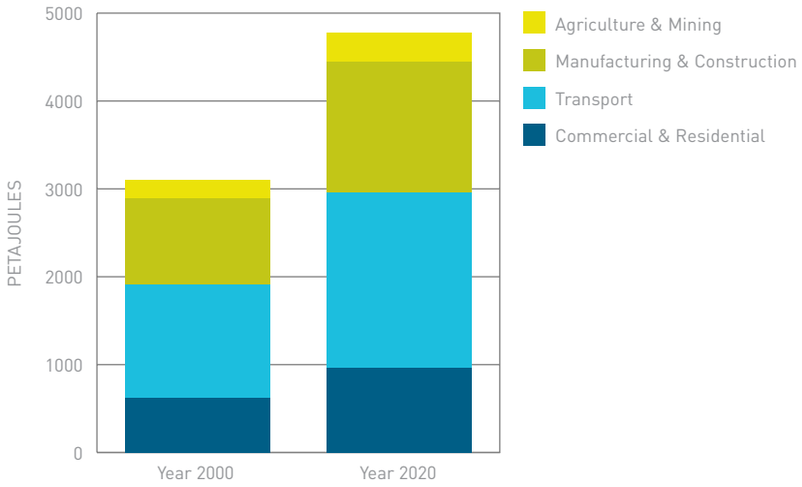
Source: Data from ABARE Australian energy: National and state projections to 2019–20, 2003

Total final energy consumption is the total energy consumed in end use. In 2000–01, total final energy consumption in Australia was 3158 PJ. This figure is 1879 PJ less than primary energy supply. The difference reflects the energy consumed or lost in conversion (e.g. electricity production and petroleum refining), transmission and distribution (e.g. pipelines and electricity wires). Final use of energy in Australia is also projected to grow in excess of 50 per cent to 4850 PJ by 2020. Final energy consumption provides the basis for analysing different end use sectors of the economy.

Forty one per cent of final energy use is for transport, almost all of which comes from petroleum products. Transport use is expected to grow quickly to 2019–20, especially air transport which is projected to grow by 120 per cent on the back of continuing strong tourism growth. The transport sector is forecast to account for around 90 per cent of the total increase in final consumption of petroleum over this period.

The largest users of stationary energy are the manufacturing and construction sectors. Industry demand growth of 50 per cent to 2020 is forecast, largely because of growth in iron and steel, and non-ferrous metals such as alumina refining and aluminium smelting.

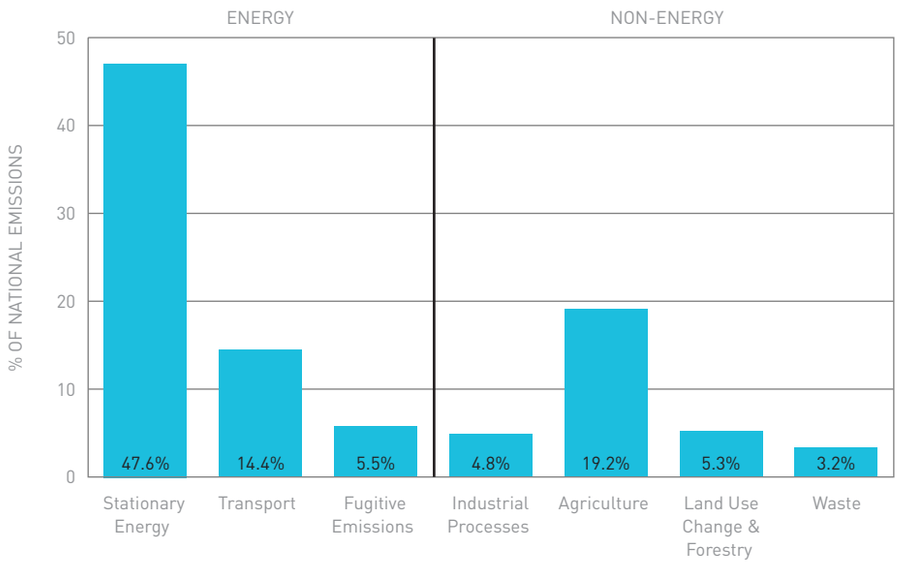
Figure 4: Total Australian final energy consumption



Source: Data from ABARE Australian energy: National and state projections to 2019–20, 2003

Energy production and use contributed 68 per cent of Australia's greenhouse gas emissions in 2002, and is expected to be 72 per cent by 2020. Non-transport energy use accounts for 53 per cent, and transport 14 per cent. Energy sector greenhouse gas emissions are expected to grow by more than 30 per cent to 2020.

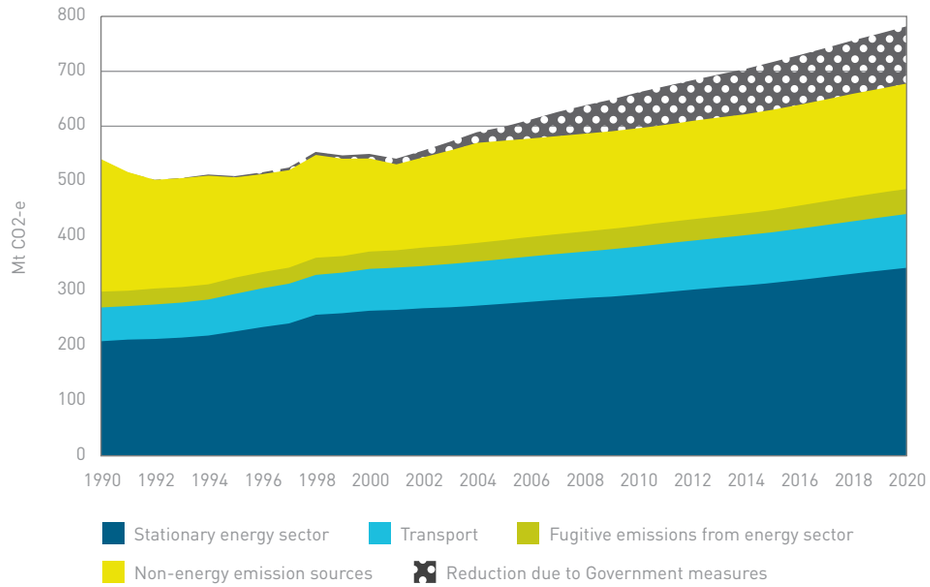
Figure 5: Estimated greenhouse gas emissions by sector in 2002



Source: Australian Greenhouse Office, National Greenhouse Gas Inventory 2002

Electricity is the biggest single source of energy emissions, accounting for two-thirds of stationary energy emissions. Recent trends show that electricity emissions will grow somewhat slower than electricity use, as there is a relative shift from brown coal to natural gas in electricity generation. Coal is the major source of base load electricity generation and its combustion accounts for 92 per cent of electricity emissions (derived from AGO 2004). Accordingly, technologies that would reduce coal emissions are potentially of great benefit to Australia's economy and environment.

Figure 6: Greenhouse gas emission projections



Source: Australian Greenhouse Office, 2004

THE POLICY ENVIRONMENT

A range of factors influences policy settings in a sound energy policy framework. Among the most influential factors for Australia are:

→ **Australia is well endowed with energy.** Australia has vast reserves of coal that are relatively easy to mine and located close to energy load centres. The country's natural gas and uranium resources are substantial, although much of the natural gas is located far from large domestic markets and uranium is not used to produce energy in Australia. The nation's oil resources are significant but reserves are declining in the absence of new discoveries. However, Australia is underexplored and further

large petroleum discoveries are possible. Potentially, liquid fuels could be produced from Australia's gas, coal or shale oil resources and biomass sources. Australia's large land area has considerable wind and solar resources, and its geology and geography provide excellent potential for power from waves and underground heat sources. Large-scale hydropower potential has been largely exploited, while some potential for smaller-scale hydro remains. Australia's biomass resources are significant but present ecosystem management challenges.

- **Australia's energy is competitively priced.** Access to low-cost reliable energy is a source of competitive advantage for Australia. This low cost is driven by ready access to relatively inexpensive sources of energy, especially coal. Energy market reform and other related policies over the last decade have created downward pressure on energy prices.
- **Australia is a major exporter of energy and energy-intensive products.** Australia earned $24.2 billion from the export of energy resources in 2002–03, of which $11.9 billion was from coal. Australia is the world's largest exporter of coal. Exports of energy-intensive refined metals and alumina earned Australia a further $18.9 billion (ABARE 2004). Australia is the world's largest producer and exporter of alumina and the world's fifth largest exporter of aluminium.
- **Energy resources make a significant contribution to government revenue, both nationally and at state level.** Australia collects around $13 billion annually from fuel excise, that is, around 7 per cent of total revenue. About $9 billion of this is retained after fuel credits, rebates and subsidies are paid. Secondary taxation of energy resources will raise another $2.1 billion for the Australian Government (Australian Government Budget 2004–05) in 2003–04 and a further $1.5 billion for state and territory governments (State and Northern Territory Budgets 2002–03 and 2003–04)[2].
- **Energy sector investments are typically large and long-lasting.** Gas and oil production facilities, power stations, refineries, transmission lines and pipelines can last for 20 to 50 years or more. These investments are needed to deliver energy services to consumers. Decisions taken today on how to meet the expected 50 per cent increase in demand for energy services by 2019–20 will have long-term effects. For example, large-scale electricity generation plant can be expected to last at least 40 years. Major new projects require up-front investments of hundreds of millions of dollars, with these costs amortised over many years. Such investments are very sensitive to perceptions of risk.

2. Compiled from state and territory government budget statements for 2003–04 for royalties on minerals and petroleum.

- **Australia's energy use is emissions-intensive.** Coal provides the largest source of power for electricity generation, with emissions at least double those of natural gas based on best commercially available technology. In transport, the passenger vehicle fleet relies on large vehicles and is energy-intensive. The truck fleet is fuel-efficient but includes many older higher-emitting vehicles. Australian per capita emissions of greenhouse gases are among the highest of the industrialised countries.
- **Australia is a small global player.** This nation's environmental actions have little direct impact on global greenhouse gas emissions. Australia is generally a technology taker, although it does have areas of market leadership. Its oil refineries and automotive manufacturers are small by world standards, and its consumer market is generally of insufficient size to significantly affect consumer product specifications. Large multinational firms dominate energy sector investments (particularly in resource development), many looking to spread risks globally across energy sources and regions.

The strong growth expected in demand for energy services implies that significant new energy investments will be needed in the coming decades. Australia's energy markets need to provide the signals for decisions to be made on the timing, type and location of these new investments. Significant progress has been made over the last decade in reforming electricity and gas markets, delivering significant new infrastructure and lower energy prices for consumers. The challenge now is to complete that reform to ensure that energy markets and investment regimes are efficient and support new investment.

Markets must provide signals for future investments that meet long-term needs, including consideration of environmental impacts. Similarly, markets must make efficient use of Australia's energy resources while managing any environmental impacts.

While energy market reforms have helped to reduce energy prices in Australia and will continue to exert competitive pressure on prices, the anticipated demand–supply gap for electricity and gas in Australia is likely to generate pressure for price increases over time.

The government must also ensure that energy continues to be reliably available. Australia has a high degree of in-built energy security flowing from its extensive energy resource endowment, existing infrastructure and access to imported fuels. Ensuring adequate investment in energy infrastructure will be critical to maintaining Australia's future energy security. Energy security policies also need to be mindful of the need to maintain competitive energy prices as very high levels of security impose high costs.

Government policy in the energy sector must simultaneously deliver prosperity, security and sustainability. The Australian Government has completed a comprehensive review of its energy policies and programmes. It has identified the challenges for the future, confirmed the broad direction of existing policies and implemented new policies where necessary. The government has set a course that will ensure that energy will continue to play a major role in underpinning the sustainability and prosperity of the Australian nation.

2

DEVELOPING AUSTRALIA'S ENERGY RESOURCES

Key Points

- Australia's abundant, low-cost energy resources are a major competitive advantage for the nation.
- Further sustainable development of these resources for the benefit of all Australians is a high priority for the Australian Government.
- Government policies are designed to maximise future development, while meeting environmental and social objectives and providing an appropriate return for the community.
- Australia is not alone in having access to energy resources, and global competition for investment and markets is intense.
- Australia ranks highly as a destination for investment across a wide range of factors.
- Australia's low level of political and policy risk, access to high-quality and low-cost pre-competitive data, reliable infrastructure, relatively low levels of red tape, quality workforce and industrial relations system are key advantages.
- The government will build on these strengths, including streamlining processes for resolving land claims and improving the quality and availability of pre-competitive geoscience data.
- Australia remains underexplored, particularly for petroleum in frontier offshore areas. Increasing the level of private exploration is a priority for the government.
- Our secondary taxation system for offshore petroleum (the Petroleum Resource Rent Tax) is world-class and was enhanced in the 2004–05 Budget to encourage exploration in designated frontier areas.
- Investors have a responsibility to ensure they actively manage greenhouse emissions, and large projects will be required to develop emission management plans through participation in the Greenhouse Challenge programme.

INTRODUCTION

Australia's access to abundant energy resources contributes greatly to living standards and the health of this nation's economy. Australia's energy resources provide consumers with low-cost energy, underpinning the competitiveness of other Australian industries, generate significant investments, and provide a major source of export revenue and secondary taxation.

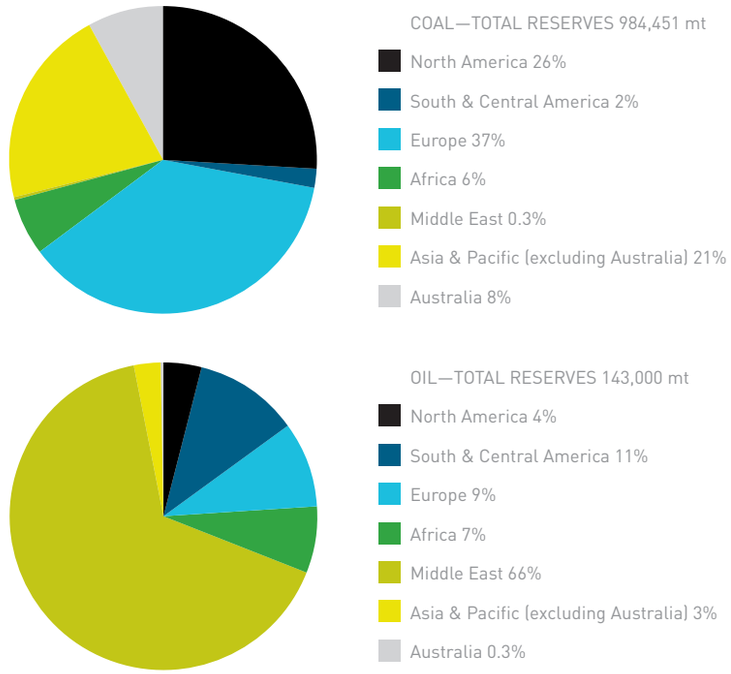
The enviable lifestyle of Australians has benefited significantly from both the wonderful natural environment and the development of energy resources. The Australian community expects the natural environment to be protected while living standards are maintained or improved. This requires the active development of Australia's energy resources in an environmentally sympathetic manner.

Australia is the world's fourth largest producer and the largest exporter of coal (IEA 2003). Australia has significant reserves of natural gas and supplies about 8 per cent of the world's liquefied natural gas (LNG) trade. Reserves of liquid petroleum are less abundant but still significant, particularly in view of how lightly Australia has been explored. Australia's reasonably assured resources of uranium at less than US$40 per kilogram make up 40 per cent of world resources (IAEA/NEA 2003). Uranium is Australia's second largest energy export in terms of energy content and plays a role in decreasing the greenhouse intensity of other nations by reducing the need for higher-emission energy sources.

Australia has extensive renewable energy resources, some of which are currently used to varying degrees such as hydro, wind and solar, and some of which are yet to be used such as waves and hot dry rocks. Australia has world-class access to wind and solar energy.

Australia is fortunate in having significant known and potential energy resources. However, many other countries also have significant energy resources which, like Australia, they are seeking to develop to meet increasing world energy demand.

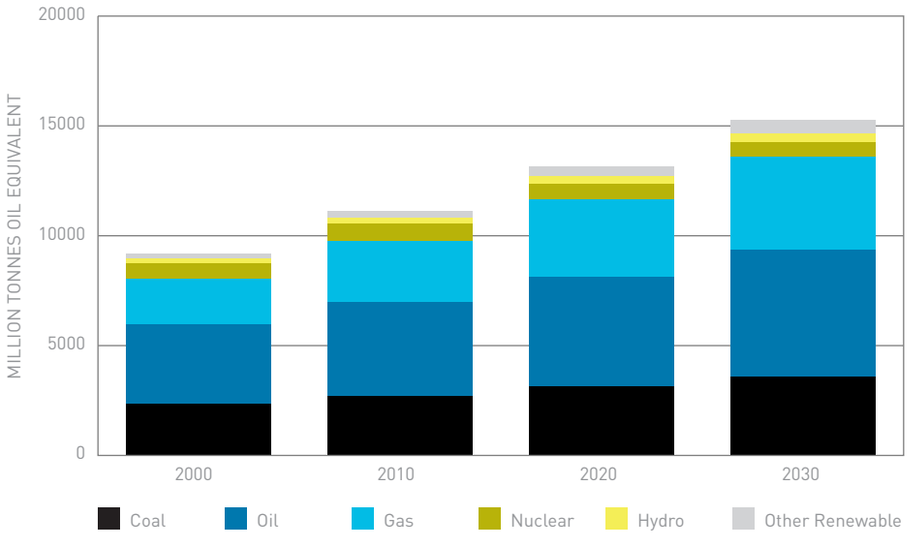
Figure 1: World reserves of coal, oil, gas and uranium by main regions, 2002



Source: Coal, oil and gas BP statistical review of world energy 2003. Uranium International Atomic Energy Agency/Nuclear Energy Agency, Uranium 2003, Resources, Production and Demand.

Additional energy resources will be needed to meet increasing world energy demand. The International Energy Agency's (IEA's) World Energy Outlook 2002 projects global energy use to grow by two-thirds from 2002 to 2030, with fossil fuels meeting more than 90 per cent of that increase. Global greenhouse responses could alter this path, but a general picture of increasing fossil fuel use is unlikely to be changed. The anticipated growth in world demand is likely to result in export markets providing a greater impetus for developing Australia's energy resources than domestic demand. Renewable energy use such as wind and biomass is expanding very quickly from a small base and provides opportunities for exports of Australian expertise in renewable technologies. Exports of renewable technology expertise are likely to be very much smaller in value than exports of energy resources.

Figure 2: World demand for energy over time



Source: International Energy Agency, World Energy Outlook 2002

The IEA has noted that the world has abundant energy resources for the coming 30 years but the challenge is to convert the resources into accessible, reliable energy supplies (IEA 2002). Enormous investments will be required to increase production to meet rising world demand and to move production to market.

Looking forward, a global response to greenhouse gas emissions could have a significant impact on the value of Australia's vast fossil fuel resources. The economic importance of these resources means that Australia has a strategic interest in finding an appropriate global response to greenhouse gas emissions and in technologies that reduce the greenhouse impact of fossil fuels and would better place Australia to contribute to the global greenhouse effort. These issues are considered in Chapter 8, Climate change and energy.

Energy resource exploration and development tends to be high-cost and high-risk. For example, petroleum exploration wells in the offshore Australian area can cost from $5 million to $55 million to drill, and experience since 1991 indicate a commercial success rate of less than 10 per cent (Wood Mackenzie 2002). Development projects are usually highly capital-intensive, with long lead times and extended lives. The prospective Gorgon LNG development, for example, would involve capital expenditure of $11 billion, take three years to construct, have an operational life of over 30 years, involve 3000 jobs in the construction phase and 600 jobs once operating. As at April 2004, $11.1 billion has been committed for capital expenditure on new energy projects in Australia. A further $38.8 billion is proposed for less advanced energy projects (ABARE 2004 b).

THE POTENTIAL RESOURCE REWARDS—THE WOODSIDE STORY

Note: The Northwest Swan on her maiden voyage, April 2004

Formed to search for oil in Victoria's Gippsland region in 1954, Woodside secured exploration permits in 1963 over 367,000 square kilometres off the Western Australian (WA) coast, now known as the North West Shelf (NWS). In the early 1970s, the North Rankin, Goodwyn and Angel gas fields were discovered. These fields were eventually to form the basis of Australia's biggest energy resource development: the NWS Venture.

Delivery of NWS natural gas to customers in WA began in 1984 under long-term contracts with the state government-owned energy utility. With deregulation of the domestic gas market in WA, the Venture now sells directly to major energy consumers. The export of Australian liquefied natural gas (LNG) began in 1989 under 20 year contracts with eight electricity and gas utilities in Japan.

In addition, spot sales of LNG have been made to Spain, South Korea, Turkey and the United States. Condensate is sold under term contracts and on the spot market. Woodside is the Project Operator and has a 50% interest in the domestic gas phase of the project and a one sixth interest in the LNG phase.

Woodside's first crude oil development was based on the Wanaea and Cossack oilfields, discovered on the NWS in the late 1980s. Production from a floating production storage and offtake facility (FPSO), Cossack Pioneer, began in November, 1995. The following month Woodside and its joint venturers also began exporting liquefied petroleum gas (LPG). In 2003 the NWS Venture accounted for 44 per cent of Australia's hydrocarbon production and generated more than $6 billion in export revenue.

In late 1999, the Northern Endeavour FPSO began producing oil from the Laminaria and Corallina oilfields in the Timor Sea, about 550 km north-west of Darwin, Woodside's first operations outside the NWS Venture. In May 2001, production commenced from a third oil production development (Legendre) located about 100 kilometres north of Dampier.

Woodside is seeking opportunities to expand its NWS operations and is seeking customer support for additional LNG processing trains. A $2.4 billion expansion of the NWS project to supply LNG to China created around 9,000 jobs around Australia over a three year construction period and is currently nearing completion. Woodside is also exploring for oil and gas throughout Australia and overseas, and has established a portfolio of major investment opportunities. Woodside is pushing ahead with the development of several major new projects in Australia and Africa and is developing market opportunities for its vast reserves of uncommitted gas in Australia's north west.

From a fledging oil and gas explorer in Victoria in the early 1950s, Woodside is now a major player not only within Australia but on the world energy stage with substantial assets and a growing international reputation as a successful oil and gas explorer, developer and producer.

Source: Extracted from 'The Woodside Story', Woodside 2004

Mobilising the necessary investment for exploration and development will depend on an investment climate in which potential investors assess that they can earn a competitive return on their investment. Decisions will primarily be made by private investors, usually multinational corporations or joint ventures of such corporations, from a global portfolio of investment opportunities. Global competition for these investments is intense.

Competing for investment is one challenge Australia faces in the development of its energy resources. Finding markets for those energy resources to justify commercial development is another. Australia's energy resources only benefit the nation if a commercial market can be found to exploit them in an acceptable manner.

For example, known gas fields in remote areas are of little value unless sale contracts are ultimately found to justify commercial development. The timing of such developments should be driven by commercial considerations, noting that 'windows of opportunity' to supply new markets may arise infrequently and require timely responses from both project proponents and governments.

Export markets hold out the prospect of development of energy resources located in remote areas of Australia which might otherwise not be developed for a long time, if at all. Domestic markets alone are unlikely to be sufficient to underwrite the development of huge, new gas fields in areas offshore of north-west Australia or coal reserves in remote areas. For example, the agreement concluded in 2002 to supply LNG to China has underpinned a $2.4 billion expansion of the North West Shelf project.

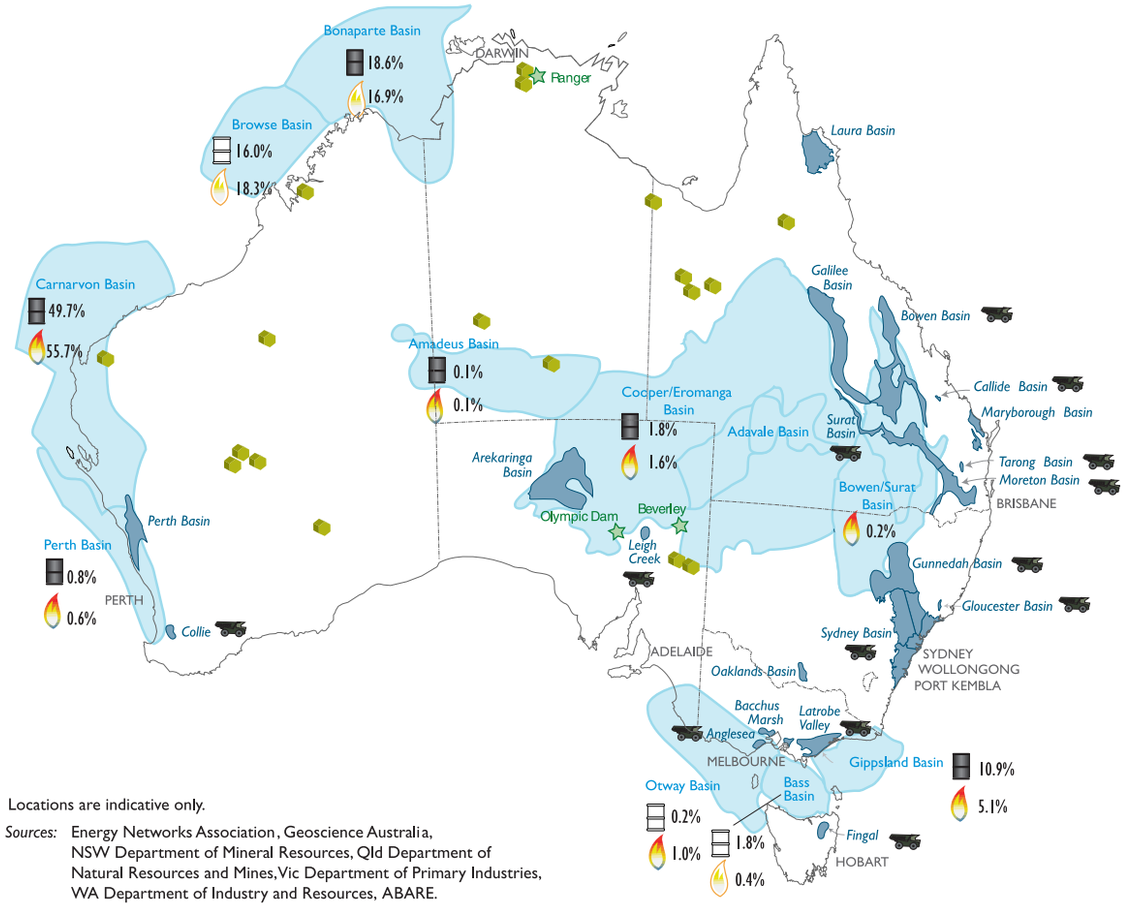
STAYING COMPETITIVE

The Australian Government's policies seek to maximise the economic value of Australia's energy resources. In doing so, the government's aim is to provide consumers with reliable supplies of competitively priced energy, ensure an appropriate return to the community for the development of its depletable resources, and meet environmental and social objectives. This requires policies that encourage private investment in the efficient identification and development of Australia's energy resources in an environmentally acceptable manner.

The Australian Government's approach in developing the nation's energy resources is guided by the following broad principles:

- Private decision makers should be allowed to manage risk in a regulatory framework that is predictable, transparent, equitable and timely.
- Energy resource developments should be required to comply with standards of environmental performance which are commensurate with those imposed on other sectors of the economy.

Figure 3: Map of Australia's coal, gas, oil and uranium resources



Locations are indicative only.

Sources: Energy Networks Association, Geoscience Australia, NSW Department of Mineral Resources, Qld Department of Natural Resources and Mines, Vic Department of Primary Industries, WA Department of Industry and Resources, ABARE.

Source: ABARE 2004

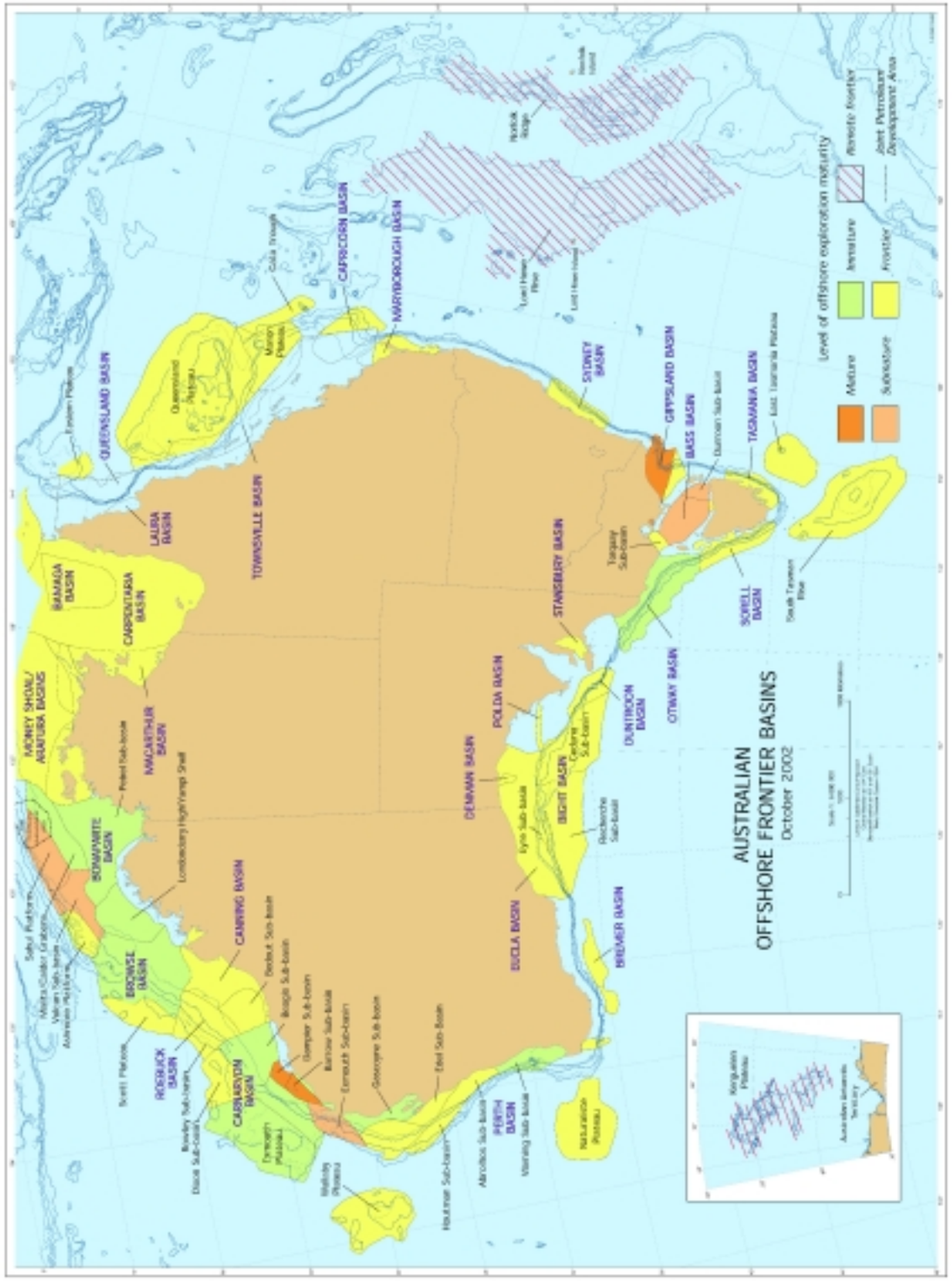
- Commercial decisions should determine the nature and timing of energy resource developments, with government interventions being transparent and allowing commercial interests to seek least-cost solutions to government objectives (e.g. environment, safety or good resource management objectives).
- Government objectives should generally be driven by sector-wide policy mechanisms rather than impose inconsistent requirements on individual projects/private investors.

Australia's competitiveness as a location for investment depends on a range of factors that, taken together, determine the commercial viability of the investments. These factors include: prospectivity (the chance of achieving exploration success and commercial development); sovereign risk levels (political, policy and regulatory); access to supporting infrastructure; access to commercial markets; and fiscal regimes and incentives.

PROSPECTIVITY

Australia has proven highly prospective for many energy resources, particularly for coal, uranium and gas. Large oil resources, such as the giant Bass Strait oil fields, have also been found in Australia but recent exploration over the past decade has created a perception of Australia as being gas-prone and less prospective for large oil discoveries. However, Australia has some 40 offshore basins that display signs of petroleum potential, and half remain unexplored due to the cost and high-risk nature of exploration in remote frontier areas. Encouraging further exploration in these areas is in Australia's interest and is a high priority for government.

Figure 4: Map of Australian offshore frontier basins



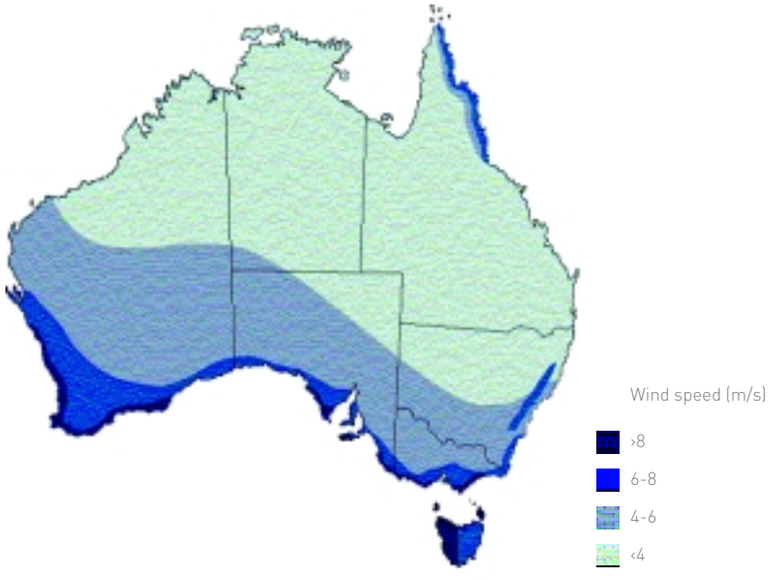
Source: Geoscience Australia 2004

Perceptions of prospectivity depend on available geological knowledge, technical capability, geological ingenuity and the prevailing climate of opinion. The provision of pre-competitive geological data can influence perceptions of prospectivity and allow companies to evaluate the risk of exploration in new areas. This information plays a key role in attracting exploration and development capital. Potential investors rank access to such information highly and it can represent a source of advantage in the competition for investment.

Government-provided pre-competitive geoscience data plays an important role in attracting exploration investment to Australia, and governments currently spend more than $90 million annually on the data (covering both mineral and energy resources). The Australian Government spends around 30 per cent of this sum (Geoscience Australia 2004). The 2003-04 Budget included $25 million to generate new geosciene data in offshore frontier areas. Government-generated geoscientific maps and data sets, company reports of previous exploration and other open-file databases, and geographic information system data are available either free or at low cost. Government collection of such data reduces risk associated with the early stages of exploration and provides economies of scale in mapping and information dissemination. Beyond that, exploration risk rests with the private sector.

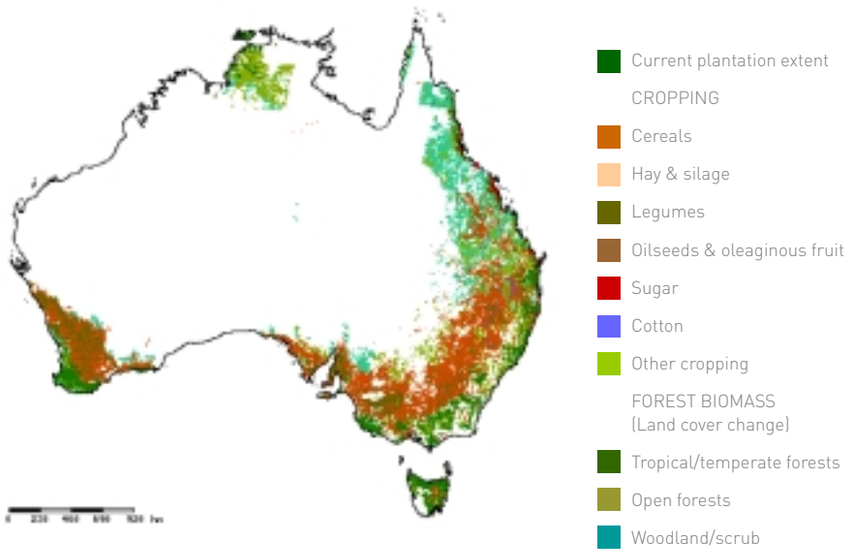
Responsibility for the provision of pre-competitive information is shared between the Australian Government and the states and territories. While current activity is focused strongly on Australia's underground energy resources (oil, gas, coal, uranium), NSW and Victoria have both produced state wind maps recently and the Australian National University enhanced previous work on mapping potential sites for hot dry rock exploitation.

Figure 5: Map of Australia's wind resources



Source: CSIRO report, Wind resource assessment in Australia

Figure 6: Map of Australia's bienenergy resources

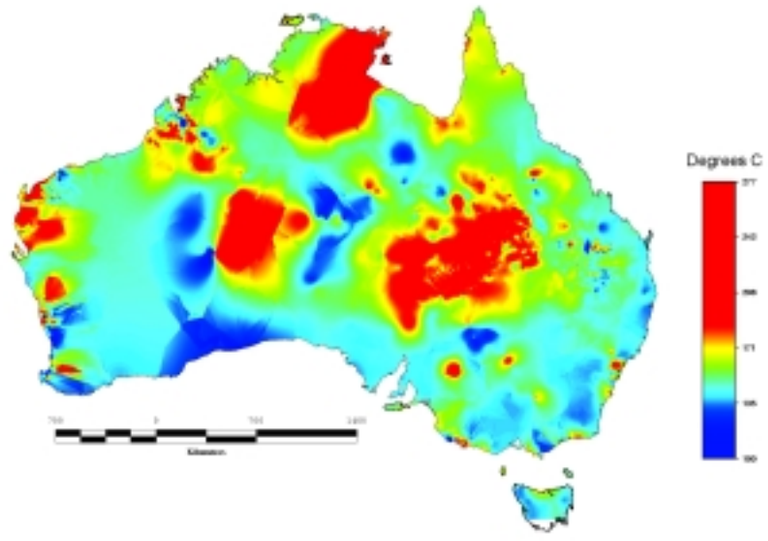


Source: Bioenergy Atlas

Figure 7: Map of Australia's solar resources

Source: Bureau of Meteorology

Figure 8: Map of Australia's geothermal resources



Source: Dr P.N. Chopra, Dept of Earth and Marine Sciences, Australian National University
Note: Map of the estimated temperature of the Australian crust at a depth of 5 km constructed from a database of 5722 wells.

Geoscience Australia and the state geological survey organisations provide quality services to private investors. The 2003 Report of the House of Representatives Standing Committee on Industry and Resources Inquiry into impediments to increasing investment in mineral and petroleum exploration in Australia made a number of recommendations to improve the quality and availability of geoscientific data, as a mechanism for ensuring more efficient exploration (Prosser Inquiry 2003). Work undertaken in the development of the Minerals Exploration Action Agenda (MEAA 2004) also identified the need to improve the availability and quality of pre-competitive geoscience data. The Australian Government sees merit in all jurisdictions working together to improve the coverage, accessibility and quality of pre-competitive geoscience information under nationwide protocols, standards and systems.

The primary focus of resource identification efforts will remain on Australia's underground resources, given the potential economic value of these resources. The Australian Government will develop protocols, in cooperation with states and territories, to guide the collection of comprehensive and consistent pre-competitive data for all energy resources (covering both underground and aboveground energy sources). These protocols will assist the more efficient exploitation of this country's extensive underground resources and provide a more coherent approach to mapping Australia's wind, solar and bioenergy resources, considering their potential role in Australia's future energy mix. The GEODISC research programme on the geological disposal of carbon dioxide has put Australia at the forefront of mapping potential sites for sequestration of carbon dioxide. Further development of Australia's potential in this area will continue to be managed by Geoscience Australia and the Cooperative Research Centre for Greenhouse Technologies. The Australian Government considers this would allow better commercial judgements to be made on the prospectivity of this approach as a means for addressing greenhouse emissions.

POLITICAL, POLICY AND REGULATORY RISK

Australia compares extremely favourably with most nations competing for investment in energy resource development in terms of low political, policy and regulatory risks. This reflects not only this country's political and social stability and respect for the rule of law, but also Australia's transparent, predictable and practical regulatory approval processes covering all stages of energy resource operations.

The Australian Government has a strategy to maintain its very low sovereign risk as a key advantage in attracting investment in resource development and delivering jobs and other economic benefits for Australians. The Australian Government welcomes foreign investment and imposes no mandatory local equity or local content requirements on energy resource developments.

Table 1: World Investment Risk Survey, 2003

	Sovereign risk	Land access	Green tape	Land claims	Red tape	Social risk	Infrastructure	Civil unrest	Natural disasters	Labour relations	Ranking
Australia	**0**	**3**	**3**	**4**	**2**	**1**	**1**	**0**	**1**	**2**	**1**
Canada	0.5	3	3	3	3	2	1	0	1	2	2
USA	0	3	4	3	3	2	1	1	1	2	3
Chile	2	2	2	2	2	2	2	2	2	2	4
South Africa	3	2	2	2	3	3	2	3	1	2	22
Indonesia	3	3	3	3	4	3	3	4	3	3	23
PNG	4	3	2	4	3	4	4	4	3	3	24
Zimbabwe	5	4	2	4	4	4	3	5	2	3	25

Note: This survey covers both minerals and energy resource investments. Higher numbers indicate higher risk.
Source: Resource Stocks, World Investment Risk Survey 2003

Differing rules apply to the development of Australia's underground and aboveground energy resources. Underground resources are generally depletable, and are owned by the community. Aboveground resources (wind, solar, waves etc.) are not generally depletable and are not 'owned' in any formal sense (although the land needed to access the resource may be). This distinction results in differing rules applying to both sets of resources.

Proponents wishing to explore for, or develop, underground resources must first gain a right from the relevant government to access and exploit the resource. In return for this right and to compensate the community for the extraction of depletable resources, governments normally impose secondary taxes on any resulting production. No such requirements apply to aboveground resources other than possibly a land access or development approval.

Approval processes need to address—and sometimes balance—various objectives such as economic development, good resource management, potential impacts on the environment, safety, and protecting the rights and interests of other parties.

Australia's approval processes are well-regarded by international investors and represent a competitive advantage for Australia. Energy projects, however, are likely to necessarily require numerous separate approvals covering matters such as access regimes, development and environmental approvals, native title, cultural heritage, foreign investment and safety plans. While individual approval requirements are reasonably based and allow the development of resources according to commercial priorities, the total impact of all the approval systems can be a source of frustration

for energy project proponents, particularly if they do not engage with the approval process until planning is well-advanced. This can create concerns about delays, and heighten coordination problems between jurisdictions. For this reason, the Australian Government's Major Project Facilitation programme, administered by Invest Australia, seeks to assist the proponents of major projects through the approval processes.

The Minerals Exploration Action Agenda recognises that a myriad of approval processes create similar difficulties for explorers and is developing strategies to identify, coordinate and streamline legislative and administrative requirements for mineral tenure, native title, heritage, environment and conservation estate. Through the Action Agenda, the government is considering ways to improve processes to facilitate regional agreements for native title and heritage protection approvals. The government is also working to increase awareness of the expedited procedure in the Native Title Act 1993 and community engagement strategies.

The Australian Government will continue to provide access to energy resources that allow investors to develop them in response to commercial objectives. Government regulation will seek to avoid direct regulatory intervention to impose non-commercial development outcomes, such as requirements to bring gas onshore for domestic consumption, for reasons other than environment, safety or good resource management. Australia's system of offshore title administration is well-regarded and the predictability of the regulatory framework enhances this country's attractiveness as a destination for investment.

An area of policy risk identified by energy project proponents relates to greenhouse emissions. The Australian Government recognises that energy projects can involve substantial domestic greenhouse emissions. The Australian Government has a comprehensive medium and longer-term climate change strategy in place to deal with the challenges caused by greenhouse gas emissions. Consistent with this responsible approach, the Australian Government considers that the greenhouse requirements for energy projects should be commensurate with those imposed on other sectors of the economy. Onerous greenhouse conditions could limit the potential for exports of Australian energy resources such as LNG which can reduce emissions overseas by reducing the need for more greenhouse-intensive fuels. Also, if greenhouse requirements in Australia cause energy projects to move to countries where environmental regulations are less strict, the net result would be an increase in global greenhouse emissions.

The Australian Government will develop, in consultation with the states and territories, protocols for more accurately forecasting the greenhouse impacts of large energy projects. Large emitters of greenhouse gases also have an obligation to ensure they are managing their emissions responsibly. To facilitate this, the government has decided that the proponents of large energy projects—with annual emissions greater than a level to be determined by the Minister for Industry, Tourism and Resources and the Minister for Environment and Heritage—be required to participate in the Greenhouse Challenge programme. Under this programme, participating companies sign agreements with the

government that provide a framework for measuring their greenhouse gas emissions, developing options for abatement and reporting on their progress.

The Australian Government is establishing a single national authority to improve regulation of safety in the Australian offshore petroleum industry. The National Offshore Petroleum Safety Authority will commence operations on 1 January 2005. An effective and efficient safety regulation regime is essential for offshore petroleum activity and will enhance Australia's reputation as a desirable location for international investment.

The Australian Government is also well-advanced in rewriting the primary laws governing offshore petroleum exploration and development to reduce compliance and administrative costs for industry and governments. Amending legislation is due to be introduced into the parliament by the end of 2004.

INFRASTRUCTURE

Australian energy resources are often in remote locations and their development usually requires significant new infrastructure such as road, rail or ports.

Potential exists for the expansion of major energy hubs such as the Burrup Peninsula and the creation of new ones to supply LNG into Asian and North American markets and gas to large-scale, locally based industrial projects. The development of commercial gas-based energy hubs could deliver significant economic benefits, something the Australian Government welcomes.

The provision of infrastructure is generally a state or territory government responsibility; however, the Australian Government has played a positive role with some investment incentives delivered through the Strategic Investment Coordination process supporting multi-user infrastructure facilities. The Australian Government's view is that provision of such infrastructure should be based on a sound consideration of commercial needs and as far as possible be driven by the market.

ACCESS TO COMMERCIAL MARKETS

The Australian Government provides investors with the freedom to sell energy resources both domestically and in export markets, subject to nuclear safeguards for uranium exports.

Market reforms, such as the development of national energy markets and open access to infrastructure, are facilitating the domestic sale of new supplies of energy. Export controls have been removed on all mineral and petroleum commodities, and developers are free to find the most rewarding markets for their products. Australia also provides relative proximity to rapidly growing energy markets in Asia and the Pacific.

The government is committed to maintaining Australia's nuclear safeguards policy for uranium exports. That policy acknowledges the strategic significance which

distinguishes uranium from other energy commodities and recognises that special arrangements need to be put in place to distinguish between the civil and military applications of nuclear energy, thereby ensuring that Australian uranium remains in exclusively peaceful use. At the same time, the policy recognises the needs of customer countries and the nuclear industry for predictability about the way Australia exercises nuclear non-proliferation conditions governing uranium supply.

The Australian Government actively supports greater market access for exports of Australian energy resources. For example, the government has played a key supportive role in obtaining access for Australian LNG in Asian markets, such as for the $25 billion contract between North West Shelf LNG and a Guangdong buying consortium. In 2002, the Australian Government made a commitment to the Chinese Government for the creation of the $25 million Australia–China Gas Technology Partnership Fund, prior to the signing of the Sales and Purchase agreement for the supply of LNG to Guangdong. The LNG industry will provide $10 million, and the Australian and Western Australian Governments will provide an equal share of the other $15 million. The government will continue to provide active support through its international relationships with other governments and international fora to remove impediments to companies seeking new markets for Australian energy resources.

FISCAL REGIMES AND INCENTIVES

Taxation requirements play a significant role in determining the relative attractiveness of energy resource projects for investors. The large scale of energy projects and consequent needs for international capital arguably make the energy sector more sensitive to the international competitiveness of Australia's fiscal regime than many other sectors.

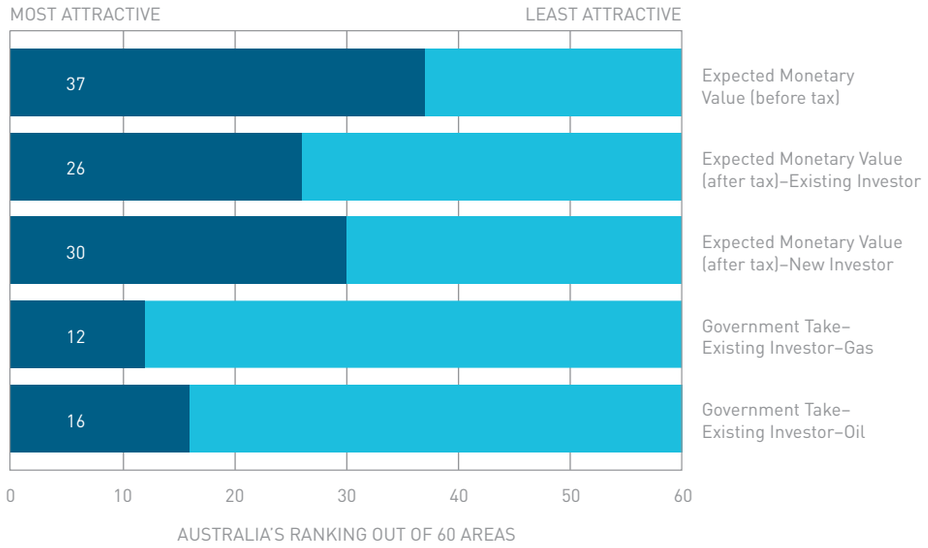
The attractiveness of Australia's fiscal regime is based on two areas: a general taxation regime that applies to all projects; and a secondary taxation system applying to use of community-owned (underground) resources. As a principle, energy sector investments are treated equally with other large investments in the general taxation system. The Australian Government has implemented major reforms to business taxation to improve the country's international competitiveness, including the reduction in the company tax rate from 36 to 30 per cent from 2001–02.

Secondary taxes apply to underground mineral and energy resources, and are applied by both the Australian (offshore) and state (onshore) governments. The taxes are designed to compensate the community for allowing the private extraction of Australia's depletable resources.

The secondary tax regimes applying to coal, uranium, gas and liquid petroleum vary across Australia. State and territory royalties apply to energy resources in those jurisdictions and are generally ad valorem. In Australian government jurisdictions (e.g. beyond coastal waters to the outer limits of Australia's continental shelf),

Petroleum Resource Rent Tax (PRRT) applies in all areas except specific North West Shelf acreage where the excise and royalty regime has been maintained in keeping with longstanding government assurances that the fiscal regime for the North West Shelf project would remain stable. An excise and royalty regime for petroleum production had existed across Australia prior to the introduction of PRRT.

Figure 9: International comparison of petroleum tax regimes



Source: Wood Mackenzie multi-client study, Global oil and gas risks and rewards, February 2002

The PRRT is a profits-based tax that automatically adjusts to changes in prices and costs. The regime has performed well, being internationally competitive and efficient. The Australian Government generally believes that profits-based taxes are preferable to ad valorem taxes for the secondary taxation of energy resources.

A measure of Australia's attractiveness, assessing both the fiscal regime and prospectivity, can be assessed from a 2002 survey done by the respected energy consultancy, Wood Mackenzie (see Figure 9). This survey measured Australia's competitiveness ranking for offshore areas in terms of exploration attractiveness and petroleum developments. The outcomes put Australia in the most attractive quarter for government take (secondary and company tax share of net revenue) and in the top half in terms of after-tax expected monetary value (monetary value multiplied by commercial success rate), a measure of exploration attractiveness. This lower rating reflects the relatively low rates of commercial discoveries in Australia since 1990, especially for oil. While very large gas discoveries have been made in Australia since 1990, it is often more difficult to commercially develop a gas discovery than an oil discovery due to the very large development costs involved with gas and the need for supporting gas markets.

More than half of Australia's offshore basins that show signs of petroleum potential remain unexplored due to the cost and high-risk nature of exploration in frontier areas. To encourage petroleum exploration in these areas, the government announced in the 2004–05 Budget that it has increased the value of exploration deductions in designated frontier areas from100 per cent to 150 per cent for PRRT determination. This effectively shifts the reward to risk balance in the investor's favour in those unexplored areas where a major new oil or gas province could be found.

The government's Strategic Investment Coordination process provides incentives to attract to Australia investment with significant net economic and employment benefits that would otherwise be located offshore. The process is designed to generate additional investment in Australia, not subsidise investment that would have occurred anyway. Projects are assessed on a case-by-case basis against stringent criteria. Invest Australia provides administrative support for the Strategic Investment Coordination process and advice to the government on applications.

Energy resource development projects and energy-intensive projects have received a significant proportion of the investment incentives granted under the process, including the North West Shelf LNG expansion, the Comalco alumina refinery at Gladstone and the Rio Tinto HIsmelt iron project at Kwinana.

LOOKING FORWARD

Significant investment is required to maintain and enhance the economic benefits available from the development of the country's abundant energy resources. The competition for this investment from other countries rich in energy resources is intense. To improve Australia's investment competitiveness, the Australian Government will build upon existing, sound energy resource development policies by:

- seeking to maintain Australia's world-leading position as a low-risk investment destination by implementing a strategy to improve land access approval processes
- ensuring that proponents of new energy projects take a responsible approach to addressing their greenhouse gas emissions and that greenhouse requirements for new energy projects are commensurate with those requirements imposed on other sectors of the Australian economy
- working with the state and territory governments to ensure that Australia maintains its world-class provision of pre-competitive geoscience data
- adjusting the PRRT to improve the incentive for petroleum exploration in Australia's remote offshore areas.

These actions will ensure that Australia maintains a competitive policy environment that will allow the efficient identification and development of energy resources in an environmentally acceptable manner and provide an appropriate return to the community.

3

ENERGY MARKETS

DELIVERING AUSTRALIA'S ELECTRICITY AND GAS NEEDS

Key Points

- Energy markets provide the key competitive framework determining the flow of energy and its price.
- In the longer term, energy markets provide the essential context for key decisions on the timing, size, type and location of the large new investments needed to meet Australia's growing demand for energy.
- Significant gains have flowed to consumers and businesses from the decade-long programme of energy market reform, and GDP has been raised by $1.5 billion per annum.
- But the task remains incomplete, and the scale of investment needed to meet future demand means that further reform is urgent.
- Australian governments agreed at the end of 2003 to a major programme of reform, including the creation of two national organisations for regulation and market development, transmission planning reforms, and user participation in markets.
- The Australian Energy Market Commission (with responsibility for rule making and market development), and the Australian Energy Regulator (responsible for day-to-day market regulation) will be established in legislation on 1 July 2004.
- Critical detail will be developed over the period 2004–06 by the Ministerial Council on Energy, informed inpart by the Productivity Commission review of the Natural Gas Pipeline Access Regime.
- Increased demand side involvement in markets—as will be demonstrated by the solar cities trial—has the potential to markedly reduce total energy demand and hence lower the greenhouse signature of the electricity sector.
- The Australian Government remains committed to a long-term national leadership role in market reform, to secure the investments needed for Australia's energy future.

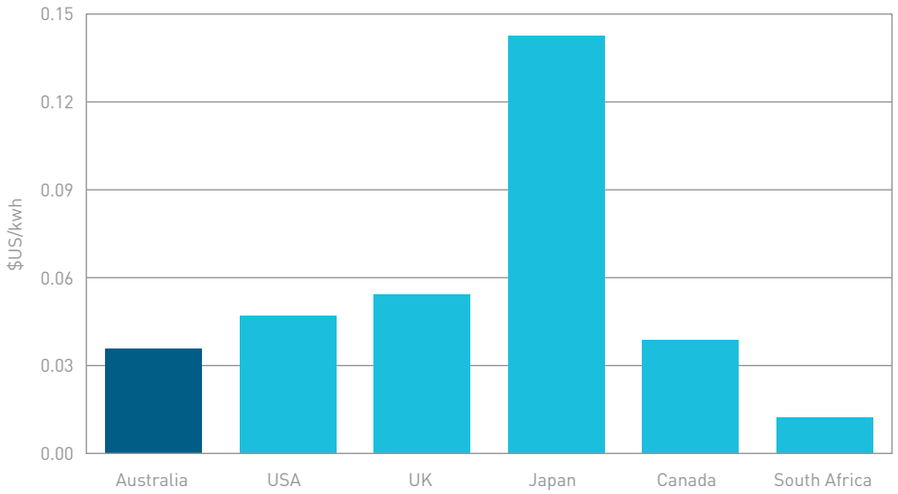
INTRODUCTION

Competitively priced stationary energy supplies (essentially provided by electricity and gas) have been an important factor in Australia's national prosperity, underpinning the Australian economy and industrial growth, and providing cheap reliable energy to businesses and households. Australia's energy prices are amongst the lowest in the OECD (see Figure 1), on the back of large accessible coal and gas resources located close to markets, and world-scale production, conversion and distribution infrastructure.

In the two decades to the year 2000, electricity demand more than doubled; gas demand also grew strongly, more than doubling in the 15 years to 1990, as major urban centres gained access to natural gas supplies. Most projections point to growth of at least 50 per cent over the period to 2020, necessitating ongoing large-scale investments in new and replacement energy supplies, infrastructure and improved energy management strategies.

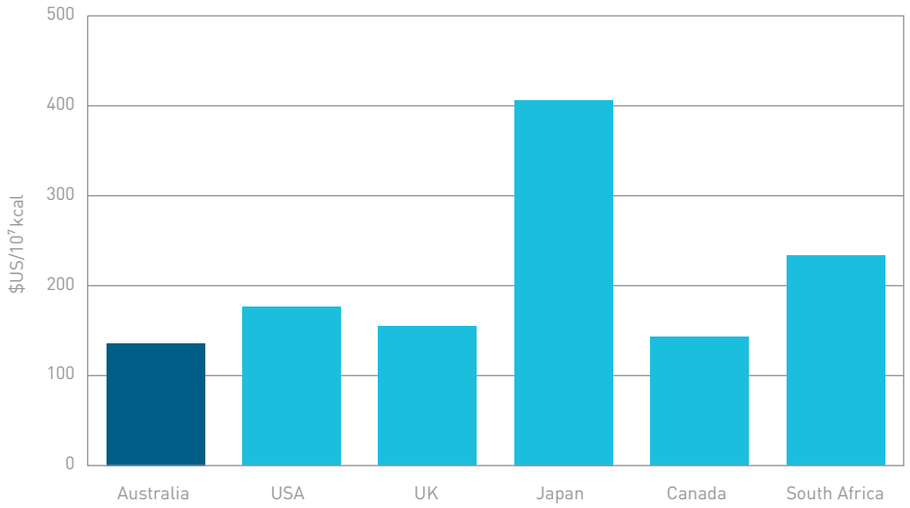
Figure 1: Comparison of industrial energy prices, 4th quarter 2002

Electricity—Industrial



Source: International Energy Agency, Key World Statistics 2003

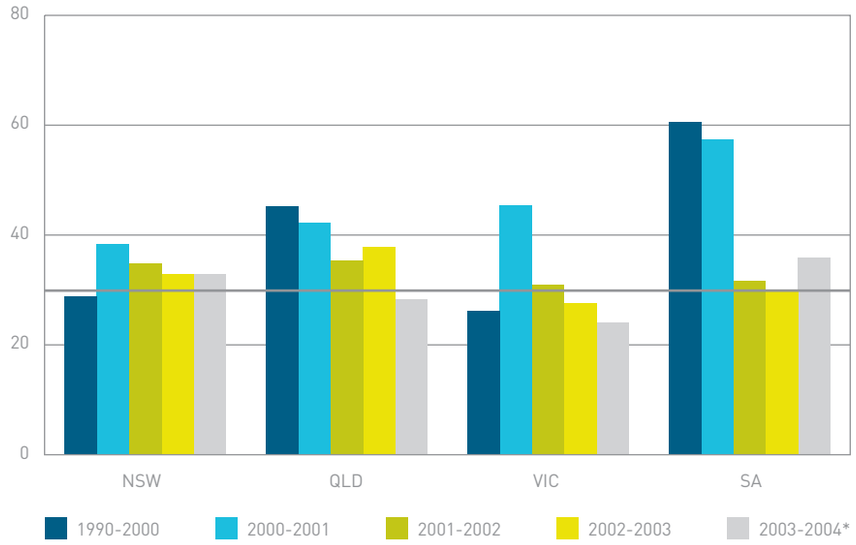
Natural Gas—Industrial



Source: International Energy Agency, Key World Statistics 2003

While in the past, governments have driven key development decisions in the electricity and, to a lesser extent, gas industries, increasingly more open energy markets are providing the essential framework within which investments in energy supply, energy use and infrastructure will be made. Market-based reforms over the last decade, culminating in the formation of the National Electricity Market in 1998, have delivered significant GDP benefits of $1.5 billion per annum, chiefly through lower prices to energy users (see Figure 2). However, large disparities in prices still exist within the National Electricity Market and, as the recently completed Council of Australian Governments (COAG) National Energy Market Review concluded, further steps need to be taken to achieve a national and efficient energy market.

Figure 2: Average annual prices ($ per Mwh) in National Electricity Market regions



Source: NEMMCO 2004
Note: Line at $30.24 represents average price across National Electricity Market 2003–04 (first nine months). South Australian prices influenced by gas shortages in first quarter of 2004.

Australia has a diverse range of possible supply sources available to meet expanding demand. Currently, a key question is whether energy markets can provide the price signals that would encourage new supply investment. The government's goal is energy markets that encourage the investment needed to deliver reliable supplies of energy at competitive cost.

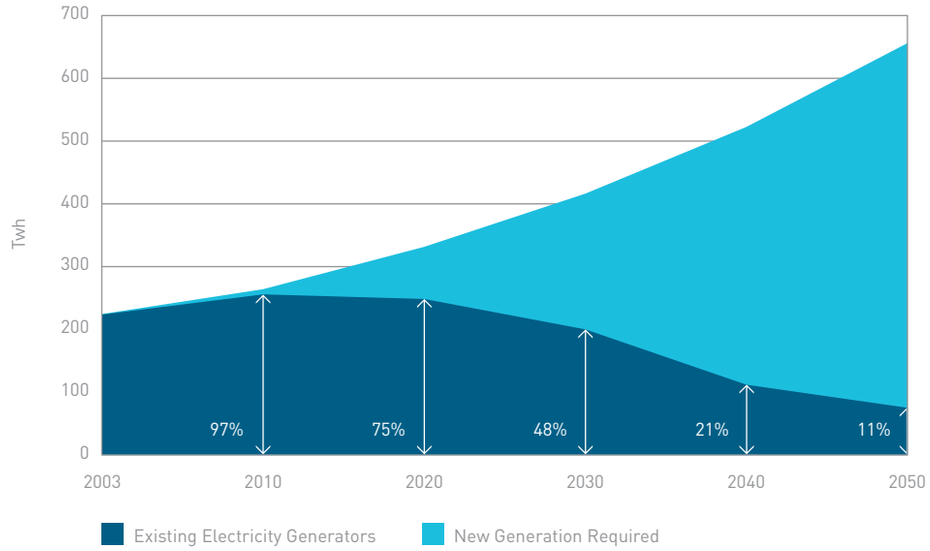
The context for achieving this goal features a number of challenges. Clear, long-term signals that encourage investment in supply, distribution and end-use technologies will be essential if future demand is to be met. Short-term, very high peak demand in electricity appears to be raising the cost of electricity provision to all users, and reducing reliability of supply. Because of the important role of the states, energy market reforms require a high level of interjurisdictional agreement and uniformity of approach nationally. Greenhouse gas emissions from stationary energy use grew by 34 per cent over the period 1990–2002 and now account for just under half of Australia's emissions.

THE URGENCY OF REFORM

Australia's energy needs are growing rapidly, necessitating large-scale new investments within the next decade (see Figure 3). The Australian Bureau of Agricultural and Resource Economics estimates that net electricity demand will rise from 186 Twh in 2000 to 230 Twh in 2010 and 284 Twh in 2020. These estimates incorporate demand

growth below economic growth, reflecting growth in less energy-intensive sectors and improvements in energy efficiency. Growth will be concentrated in the eastern states (some 80 per cent), with 60 per cent in New South Wales and Queensland. While there is currently underutilised generating capacity, it is clear that servicing these levels of demand will require significant investment in generation and transmission capacity. Refurbishment of existing networks and replacement of older plant will place additional demands on investment resources. The electricity and gas industries are both capital-intensive; the energy industry has estimated that investment of at least $37 billion will be needed over the period to 2020 to ensure that Australia's energy needs are met. Moreover, lead times are long; new large-scale base load generation capacity has lead times of four to seven years. Hence the urgent need to improve functioning of energy markets—in particular, the policy and regulatory certainty regarding large, long-lived potential investments in energy supply and distribution.

Figure 3: Demand/Supply balance for electricity—Medium electricity demand scenario



Source: Australian Greenhouse Office internal analysis (data source: Roam Consulting)

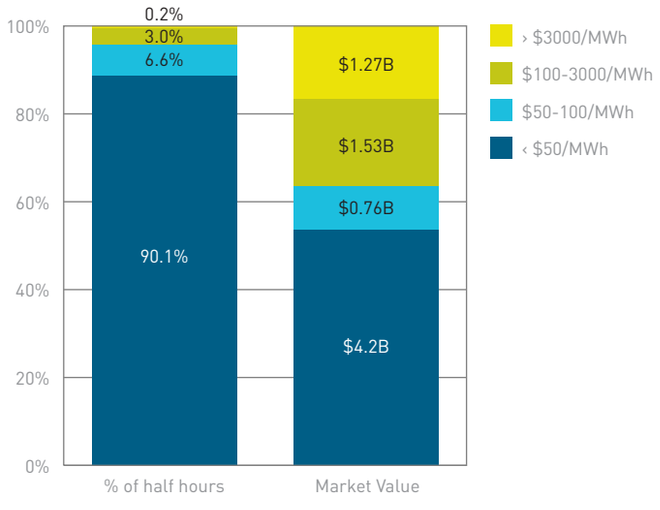
New technologies are also emerging, promising more efficient energy provision, and possible improvements in greenhouse gas emissions. Consumers and energy-intensive industries will continue to require competitively priced energy, while demanding reliable, secure supplies. Australia's energy markets provide the background against which key decisions will be made on the timing, size, location and type of new investments including supply, transmission and user equipment. Those decisions are central to delivering reliable energy supplies with an environmentally sustainable footprint at a competitive price. Furthermore, energy markets provide the basic framework within

which other policy approaches function. Energy market reform is an important step for improvements in energy security, energy efficiency and innovation. Pursuing these approaches in the absence of remedying defects in market design is likely to be at best inefficient, at worst ineffective or even counterproductive.

ENERGY MARKET ISSUES

Matching gas and electricity supply and demand is complex. In the case of electricity, where storage is expensive, demand and supply must be matched exactly on a continuous basis, using a complex mix of differing technologies and fuel sources. For example, coal-fired power plants generally supply base load power demand, while gas plants respond to daily or seasonal peaks in demand, but tend to deliver more expensive electricity than coal-fired plants. Some renewable sources, such as wind and solar, are intermittent, but in the case of solar technologies maximum output closely correlates with summer peak demands. These peaks in demand, while generally being of short duration, can impose high costs on the supply system. Figure 4 shows that peaks lasting for only 3.2 per cent of the annual duration of the market accounted for 36 per cent of total spot market costs. Reducing the magnitude and costs of these peaks will reduce overall system costs.

Figure 4: Value of spot market—National Electricity Market, 2002



Source: Port Jackson Partners Ltd—Based on the maximum National Electricity Market pool price in any half hour in any region

These higher supply costs are rarely directly reflected in customers' costs, which tend to be averaged over a longer period. Hence demand side responses, whereby users adopt more energy-efficient technologies or shift their demands to less costly periods, are muted or non-existent. Blackouts or similar weakening of system reliability are most likely at times of peak demand. Improving price signals provides a pathway to address these issues; by reducing peak demands, overall costs can be lowered for all users and system reliability enhanced.

The monopoly characteristics of markets for electricity and gas have led governments over the world to regulate these markets. The tension between consumer protection and the essential encouragement of investment is strong, and requires a carefully balanced and focused approach. The need for consistency and certainty in regulation is exacerbated by the high capital intensity of energy supply industries, the long lead times and long economic life of investments. Worldwide regulatory reform has seen governments reducing their energy supply operations through asset sales or other means, and an increasing focus on regulating the natural monopolies found in energy markets, notably electricity and gas transmission and distribution.

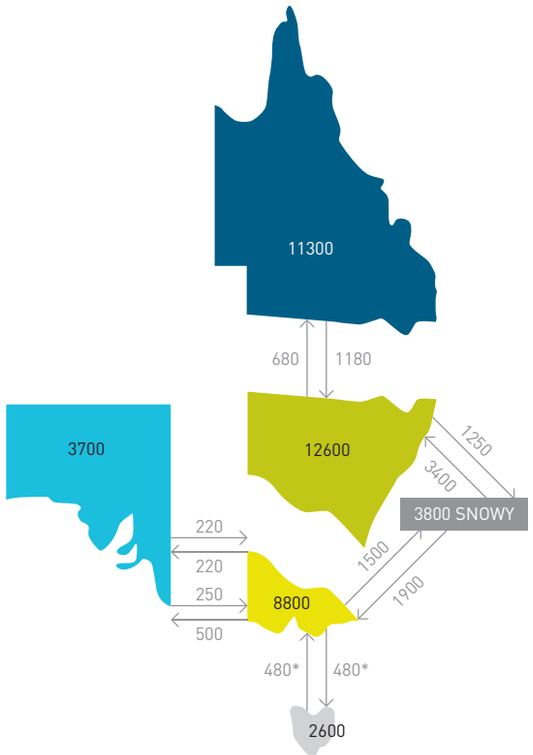
PROGRESS TO DATE

In the 1980s, most electricity and gas markets were based at state level, and were weakly linked, if at all. In some cases, gas 'exports' from one state to another were prohibited, even when they were the most economic source of supply. Security of supply was generally provided by large surpluses in production capacity, but blackouts still occurred from time to time. Energy market reform began to gather force internationally in the 1980s and was given impetus in Australia in the early 1990s through reviews by the Industry Commission and the Independent Committee of Inquiry into National Competition Policy. These inquiries identified significant benefits available from introducing more competitive markets in electricity and gas. Consequently, Australian governments engaged in a major reform programme, including disaggregation, corporatisation and privatisation of utilities, culminating in the commencement of the National Electricity Market in 1998. They implemented major reforms to the national natural gas industry, including the National Third Party Access Regime for Natural Gas Pipelines (the Gas Code) in 1997. Agreement was also reached to move to full retail contestability, to ensure retail customers received the benefits of market reform (noting that, at this stage, Victoria and South Australia are the only two states to have introduced full retail contestability).

Market reforms have brought significant benefits. Energy prices to most classes of consumers and in most regions have dropped in real terms. The competitiveness of Australian industries has been maintained and improved. Independent analysis has found that energy market reforms to date have contributed $1.5 billion per annum to the economy as a whole. New private sector investment has made a significant

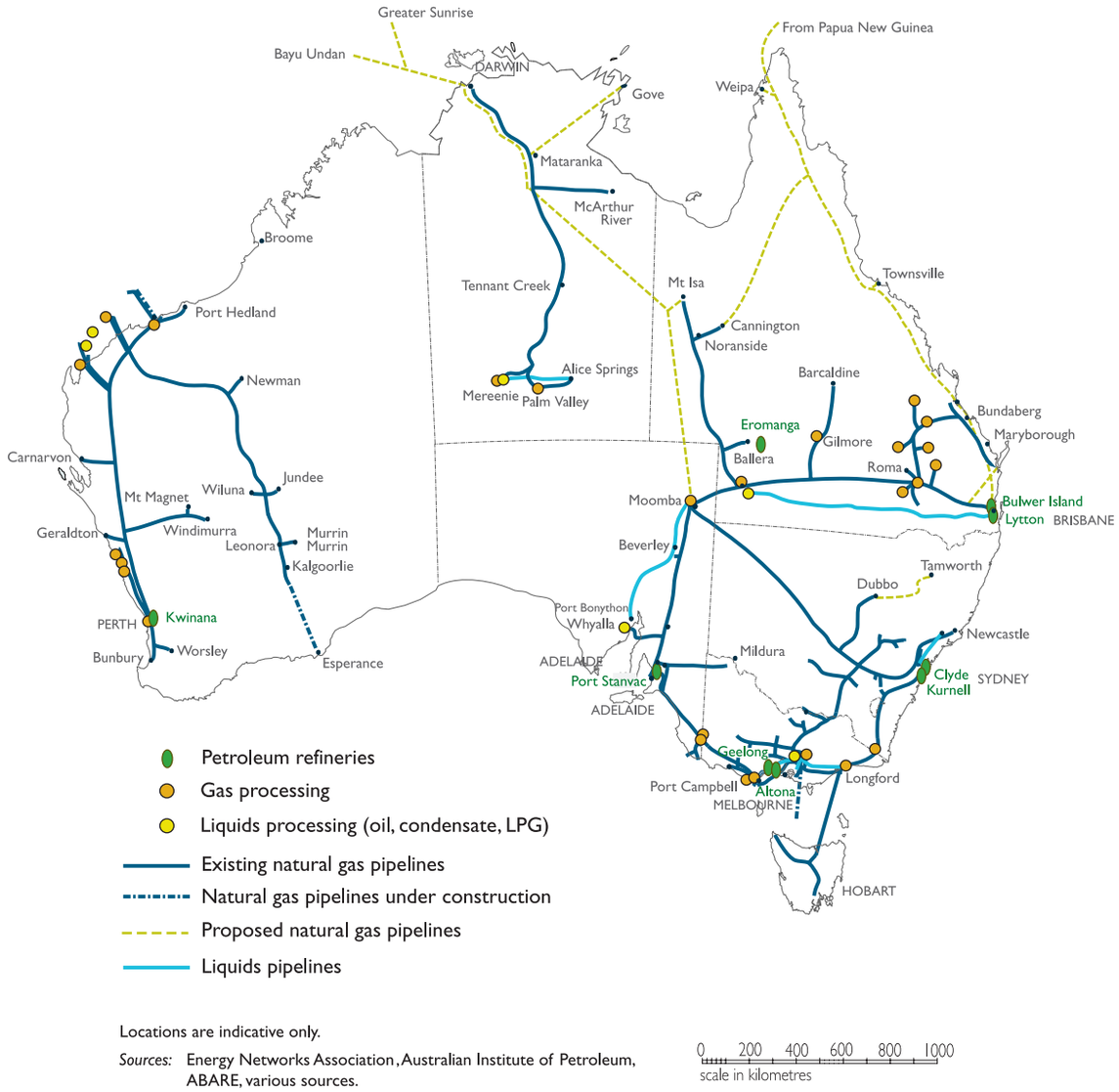
contribution to new energy production and distribution infrastructure, producing interlinked gas and electricity markets, improving the reliability and security of energy supplies. Major new power stations have been built in Victoria, New South Wales and Queensland including, for example, Callide C, Swanbank E, Tarong North and Milmerran. In May 2004 it was announced that a new station will be built at Kogan Creek in Queensland. New electricity interconnections have been planned and built between jurisdictions, as well as new gas pipelines connecting Bass Strait to Sydney and Adelaide (see Figure 5 showing state generating capacities, and the capacity of interstate interconnectors, and Figure 6, interstate gas pipelines). A good example of the impact of these developments was provided at the beginning of 2004, when Adelaide's major gas supply from Moomba was interrupted. Gas supplies were available from Victoria via the new SEA Gas pipeline, and a large portion of South Australia's normally gas-derived electricity was supplied from eastern states markets via interconnections, which were able to provide up to a quarter of the state's needs even at times of peak demand. In the absence of these links, the impact on South Australian businesses and households would have been substantial.

Figure 5: State generation capacity and Interstate electricity connections in megawatts capacity



Source: Data ESAA 2003. Note that Basslink connecting Tasmania to Victoria is expected to be completed by late 2005

Figure 6: Refining and gas infrastructure in Australia



Locations are indicative only.

Sources: Energy Networks Association, Australian Institute of Petroleum, ABARE, various sources.

Note: The Port Stanvac refinery was mothballed in 2003.

Australia has avoided the energy shortages and widespread and prolonged blackouts experienced in other countries. The country's reforms have had a strong market orientation, favouring efficient outcomes, and there is no doubt that these reforms have helped underpin Australia's strong economic performance over the last decade, as declining energy prices have improved competitiveness and profitability.

Notwithstanding these achievements, it was clear by 2001 that confused and overlapping regulatory arrangements were more complex than necessary, creating uncertainty and hindering investment. In addition, network regulation seemed to be affecting transmission investment. Australian governments recognised in 2000 and 2001 the need to achieve further progress. In June 2001, COAG agreed on national energy policy objectives, emphasising the central role of competitive and sustainable national energy markets, and the need to continually improve those markets if price, reliability and environmental objectives were to be met. COAG also agreed on the need to improve transparency and clarity in governments' decision making if the large-scale investments, needed to meet energy demands, were to occur in a timely way. One key outcome was the establishment of the Ministerial Council on Energy to coordinate interjurisdictional cooperation, including in energy market reform.

A NATIONAL ENERGY POLICY FRAMEWORK

Governments agreed to establish a national energy policy framework to guide future energy policy decision making by jurisdictions and to provide increased policy certainty for energy users, including households and small business, and for the energy sector.

Agreed objectives

COAG agreed to the following national energy policy objectives:

- encouraging efficient provision of reliable, competitively priced energy services to Australians, underpinning wealth and job creation and improved quality of life, taking into account the needs of regional, rural and remote areas
- encouraging responsible development of Australia's energy resources, technology and expertise, their efficient use by industries and households, and their exploitation in export markets
- mitigating local and global environmental impacts, notably greenhouse impacts, of energy production, transformation, supply and use.

Agreed principles

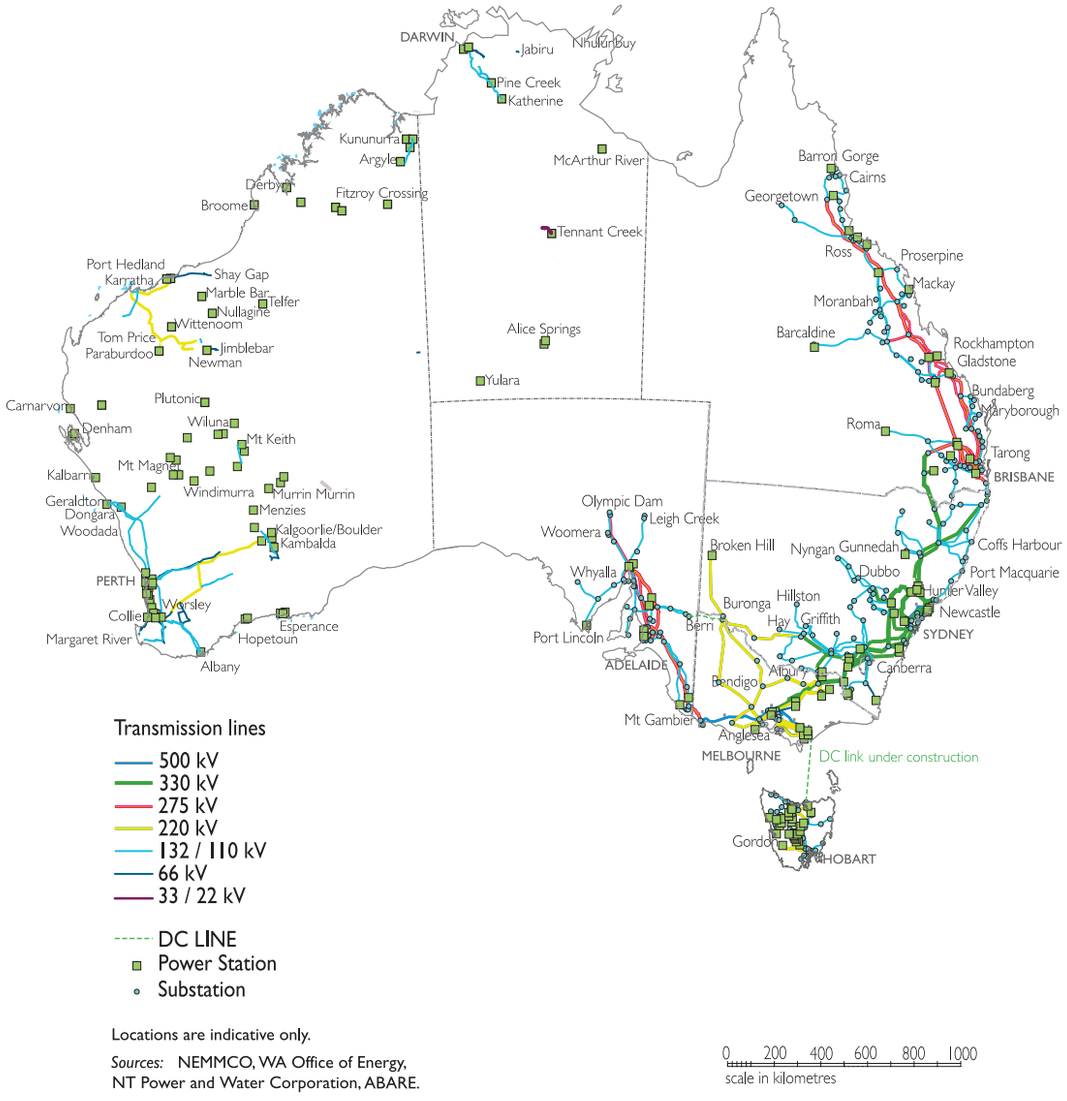
Consistent with these agreed objectives, and in light of their responsibilities under the constitution, all Australian governments agreed that their energy policies will:

- recognise the importance of competitive and sustainable energy markets in achieving these objectives
- continuously improve Australia's national energy markets, in particular between and among jurisdictions and—recognising growing convergence between energy markets—between energy sources, and supply and demand side opportunities
- enhance the security and reliability of energy supply, encompassing resource availability, conversion, transportation and distribution, and recognising the impact of government policy and the regulatory environment on private sector investment and operation
- stimulate sustained energy efficiency improvements to technologies, systems and management proficiency across production, conversion, transmission, distribution and use
- encourage the efficient economic development and increased application of less carbon-intensive (including renewable) energy sources and technologies, including exploring opportunities for appropriate inter-fuel substitution
- recognise that Australia's energy markets operate in the context of world energy markets and seek to enhance Australia's international competitiveness in these markets
- in view of the importance of long-term investment in the energy sector, provide the degree of transparency and clarity in government decision making required to achieve confidence in current and future investment decisions
- carefully consider the social and economic impacts on regional and remote areas, with particular regard to businesses, industries and communities
- facilitate constructive, effective interjurisdictional cooperation and productive international collaboration on energy matters.

COAG agreed to a wide-ranging review of the strategic direction of stationary energy market reform in Australia; key findings of that review were published at the end of 2002. The review recommended an ambitious programme of reform. Measures included significant changes to improve and streamline governance and regulation, a market-oriented approach to transmission, and novel demand side proposals. The projected impact on GDP of the review's reform programme was estimated at nearly $7 billion in net present value terms over the period 2005–10.

In June 2003 the Australian Government, in consultation with the states and territories, commissioned the Productivity Commission review of the Gas Code for natural gas pipelines. The review will build on the government's response to the review of Part IIIA of the Trade Practices Act (the National Access Regime). The review of the Gas Code, expected to be finalised in June 2004, covers the five years of the Code's operation. The draft report of the inquiry recommended a less costly regulatory regime, and a sharpened focus on competition and efficiency, including possible regulatory holidays.

Figure 7: Electricity transmission networks



DECEMBER 2003 ACTION PLAN

Australian governments responded substantively to the COAG review proposals in December 2003. These responses covered governance, regulation, transmission planning, energy user participation, and increasing natural gas penetration.

On **governance**, the Ministerial Council on Energy will become the single national energy market governance body, underpinned by a national legislative framework.

Regulation was addressed through commitments to establish two new national institutions, the Australian Energy Market Commission and the Australian Energy Regulator to administer market regulation.

A suite of new developments addresses **transmission planning** including a new transmission planning function, a new regulatory test for transmission investments, new processes for determining wholesale market regional boundaries, and market-based incentives for transmission performance.

User participation was to be addressed through alignment of retail price caps with costs, plus examination of demand side response pools and interval metering.

On **gas penetration**, the Ministerial Council on Energy committed to respond to the Productivity Commission review of the Gas Code. The work of the Ministerial Council on Mineral and Petroleum Resources covering joint marketing of gas, access to upstream facilities, and the appropriate treatment of unproduced areas of production licences due for renewal was noted.

The Ministerial Council on Energy took a major step forward in April 2004, reaffirming their commitment to passing necessary legislation by 1 July 2004 to establish the Australian Energy Market Commission (responsible for rule making and market design) and the Australian Energy Regulator (responsible for day-to-day regulation). Transmission reforms are to be advanced by a national planning regime, underpinned by the Annual National Transmission Statement to improve interconnector development. The first such statement is expected in July 2004. Ministers also agreed to expand the gas market element of the reform programme, integrating consideration of the Productivity Commission review of the Gas Code and the outcomes of the SA–NSW–Victoria–ACT Gas Infrastructure Taskforce established after the Moomba incident. Consultation with industry and users will be an integral part of this work.

The Ministerial Council on Energy agreements of December 2003 and April 2004 provide the framework for the next stage of reform; much of the critical detail will be developed and implemented in 2004–06. The Australian Government will be an active participant with the states and territories in the implementation of this next reform phase, but will also take a long-term strategic national view. It will closely monitor market outcomes to ensure that reforms deliver the necessary investment climate to underpin energy security, reliability, competitive prices and sustainability. These are issues where the national interest outweighs that of an individual state or territory.

Key implementation goals on which the Australian Government and states and territories have agreed include:

Governance: The quality, timeliness and national character of energy market governance must be strengthened. The single national regulator is seen as a key development in this regard. Responsible governance is required to develop and administer the legislative framework within which the market operates and natural monopolies are regulated, to make appointments to statutory bodies that determine market rules and undertake regulation, and to provide policy direction where appropriate. Governments should not be directly engaged in the day-to-day operation of markets or overseeing the conduct of regulators, but must focus on longer-term, systemic and structural issues that affect the public interest.

Economic regulation: Nationally, economic regulation across energy markets must be streamlined and improved to lower the cost and complexity of regulation facing investors, enhance regulatory certainty and lower barriers to competition. The Australian Energy Regulator, the Australian Competition and Consumer Commission and the Australian Energy Market Commission will have clear and distinctive roles, and cooperate to avoid unnecessary duplication. The rule-making functions of the Australian Energy Market Commission and regulatory functions of the Australian Energy Regulator must include the wholesale, network and retail elements of the energy market. The initial focus will be on electricity transmission regulation, the gas access regime, distribution and retail regulation, and gas market development.

User participation: Participation of energy users in the markets needs to be enhanced, including through demand side management and the further introduction of retail competition to increase the value of energy services to households and business. This offers a key way to reduce the high cost and reliability impacts of escalating peak demands in gas and especially electricity systems.

NEW ELECTRICITY-GENERATING TECHNOLOGIES

The Solar Cities trial, as described in detail in Chapter 8 Climate change and energy, will address a number of energy market issues. This Australian government initiative aims to demonstrate the benefits that can accrue to energy markets from the deployment of renewable photovoltaic (PV) electricity production close to its point of demand, and the deployment of energy efficiency technologies, including interval meters, to empower demand side responses to price signals. A close correlation exists between PV production and times of peak demand in southern states, highlighting its potential to reduce the costs associated with meeting peak demand and improving system reliability. Careful monitoring of the impact of these technologies should provide a clear indication of their value in providing reliable, competitive energy services, while reducing consumers' electricity bills.

The Australian Government will also continue to ensure national energy markets are responsive to distributed generation (where generation is located close to demand) and demand side management (where energy users receive incentives for reducing use, especially at peak times). The Government will work with the states and territories to identify by December 2005 and act on rule changes required in the National Electricity Market to maximise the benefits of distributed generation.

Some important low emission technologies, especially wind and solar, are intermittent, presenting a major impediment to their wider uptake. To address this, the Government will establish an $18 million fund to support development of advanced electricity storage technologies. This programme will provide funding on a competitive basis to leverage investments in demonstrating technologies such as advanced batteries, electro-mechanical storage (e.g. flywheels) and chemical energy storage.

LOOKING FORWARD

For the future, the Australian Government's goals in accelerating the drive for an open, efficient and fully competitive national energy market are to:

- stimulate the long-term infrastructure investments required to meet future energy demand
- facilitate the development of new energy technologies, products and services
- provide for competitive neutrality between public and private sector investment
- support active demand side involvement in this single energy market
- promote energy efficiency objectives and low-emission technologies
- ensure there is competitive trade, within and across state borders, in energy services and supplies
- promote conditions conducive to the delivery of a wide range of reliable and competitively priced services to the benefit of all energy users and consumers
- underpin Australia's future economic prosperity and the sustainable development of this country's natural resources.

More specifically, the Australian Government will pursue:

- a national energy access regime, with the emphasis placed on service delivery and the role that electricity network and gas pipeline infrastructure can play in providing for competitive market outcomes
- competitive wholesale markets for natural gas in Melbourne, Sydney, Brisbane and Adelaide, with the direct engagement of industry, end users and investors in market design and rule-making requirements

- strengthened financial markets for natural gas and electricity to underpin liquidity and help manage risk
- commercialisation strategies that value the benefits of embedded generation (such as PV systems) and low-emission technologies in the suite of energy technologies available to this market
- national emergency response protocols, involving governments, industry and users, to better coordinate responses to national energy supply emergencies and to minimise their economic impact, notably in gas, to complement those existing for the petroleum products industry (see Chapter 7, Energy security).

The Australian Government is committed to a long-term national leadership role in ongoing energy market reform. The government intends to work collaboratively with the states and territories through the Ministerial Council on Energy. The core interest is development of an open, efficient and competitive market that is attractive to investors, provides competitive prices for users, allows the market to manage risk adequately, and delivers energy with a lower greenhouse signature.

While much progress has occurred in the last decade, the National Electricity Market is still largely a series of regional markets with limited interconnection, and the gas market is still quite immature and developing. The full economic benefits that an integrated approach to national energy policy has to offer are yet to be realised. A truly competitive, national energy market holds the key to longer-term energy security, enhanced energy efficiency, higher rates of greenhouse gas abatement and the progressive commercialisation of renewable and low-emission technologies.

Investment is the key to meeting future demand growth, delivering reliable and competitively priced energy services, and attracting the energy supply and demand technologies required to secure Australia's energy future. The government is confident that the market reforms set out above will provide the certainty needed to encourage the capital and technology investments for Australia's future energy needs and progressively reduce the greenhouse intensity of energy supplies.

4

ENERGY MARKETS

DELIVERING AUSTRALIA'S TRANSPORT FUEL NEEDS

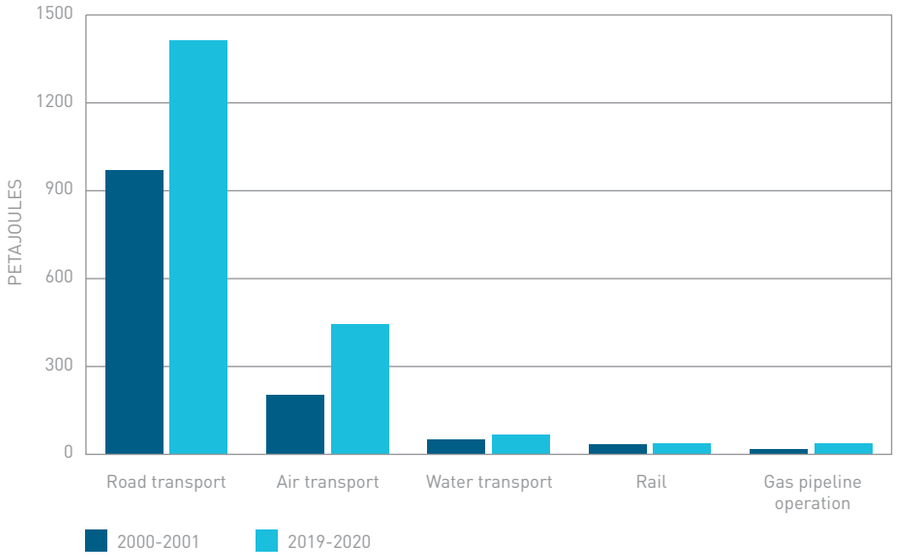
Key Points

- Australia's transport system makes a significant contribution to our economic and social welfare, and Australians enjoy access to low-priced fuel by world standards.
- Demand for transport fuels is projected to rise significantly in the period to 2020. How this demand is met will determine the ongoing competitiveness of our transport sector.
- Australia, like the rest of the world, relies heavily on petroleum-based fuels to meet its transport energy needs. This reliance will continue well into the future, even allowing for the greater penetration of alternative fuels.
- The Australian Government is committed to providing a market framework that delivers reliable supplies of competitively priced transport fuels, in a way that meets broader environmental and social objectives.
- Meeting this objective requires markets that facilitate strong and fair competition in the domestic market and reliable access to import and export markets.
- The transport fuels sector, like many others, has undergone a long period of consolidation over the last 20 years, which has improved its overall competitiveness. The pressure for structural changes will continue.
- Reform of the transport fuels market is desirable and the government has set out a comprehensive reform package. The government looks forward to broad industry support for these reforms.
- Fuel standards are an important element of the transport fuel market. The government will continue to consult with stakeholders in the setting of future standards to balance environmental objectives with competition and industry objectives.
- A generous policy framework is in place for alternative fuels. This framework allows time for this sector to develop and compete with traditional petroleum-based fuels.

INTRODUCTION

The transport sector accounts for 41 per cent of total Australian final energy consumption. Transport energy comprises road transport (accounting for 76 per cent of transport fuel consumption), air transport (16 per cent), water transport (4 per cent), rail transport (2 per cent) and gas pipeline operation (2 per cent) (ABARE 2003)[i].

Figure 1: Projected growth in transport energy consumption by sector



Source: Data from ABARE, **Australian energy: National and state projections to 2019–20**

Demand for transport energy is projected to grow at about 2.4 per cent per annum. At this rate of growth, the demand for transport energy will increase by about 50 per cent by 2019–20. The transport system is heavily reliant on petroleum-based fuels, which meet more than 97 per cent of Australia's total transport needs. This is in line with world trends. Electricity powers some rail transport, coal powers some water transport, natural gas powers gas pipelines, and biofuels and natural gas play a very minor role in meeting our road transport needs (ABARE 2003).

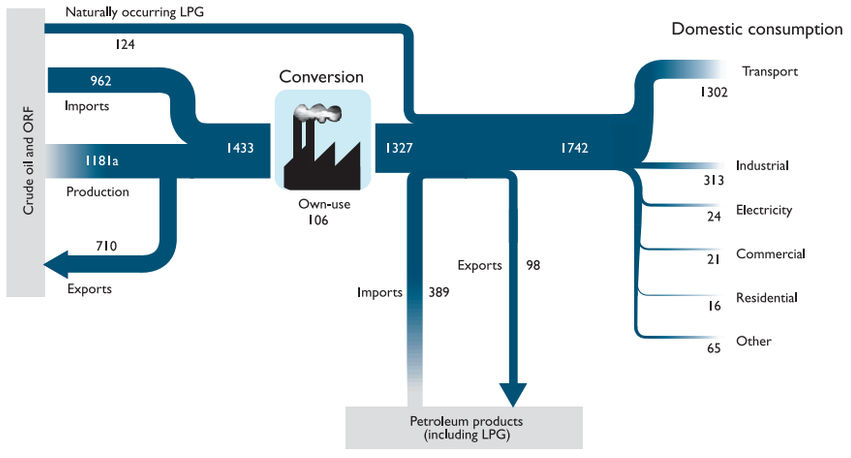
Australia's heavy reliance on petroleum fuels for transport is expected to continue because of the lack of competitively priced alternatives, the long life expectancy of existing fuel production and distribution infrastructure, and the stock of vehicles. The next generation of vehicles, which will include some hybrids, will not significantly change this. Alternative transport fuels such as hydrogen, while potentially offering significant environmental benefits, are some time away from being price-competitive or being ready for mass application. This is despite regular fluctuations in oil prices, which have resulted in quite high petrol and diesel prices for periods of time.

The Australian Government is committed to providing a market framework that delivers reliable supplies of competitively priced transport fuels in a way that meets environment and fuel security objectives.

MEETING THE DEMAND FOR FUEL

Australia meets its demand for petroleum fuels from both domestically produced and imported refined petroleum products. Australian refineries also export product into mainly Pacific nation markets. While the vast majority of Australia's demand is met from domestically refined fuel, imports play an important role. For example, it is often cheaper to supply northern regions of Australia from Asian refineries than from refineries in southern Australia. Also, in recent years, independent importers have taken advantage of excess refinery capacity in Asia to source competitively priced imports of petrol. Recent reductions in refining capacity in Australia, such as the mothballing of the Port Stanvac refinery in 2003, and growth in demand, mean that imports are likely to play an increasingly greater role in meeting domestic demand. The energy security aspects of this are discussed in Chapter 7, Energy security.

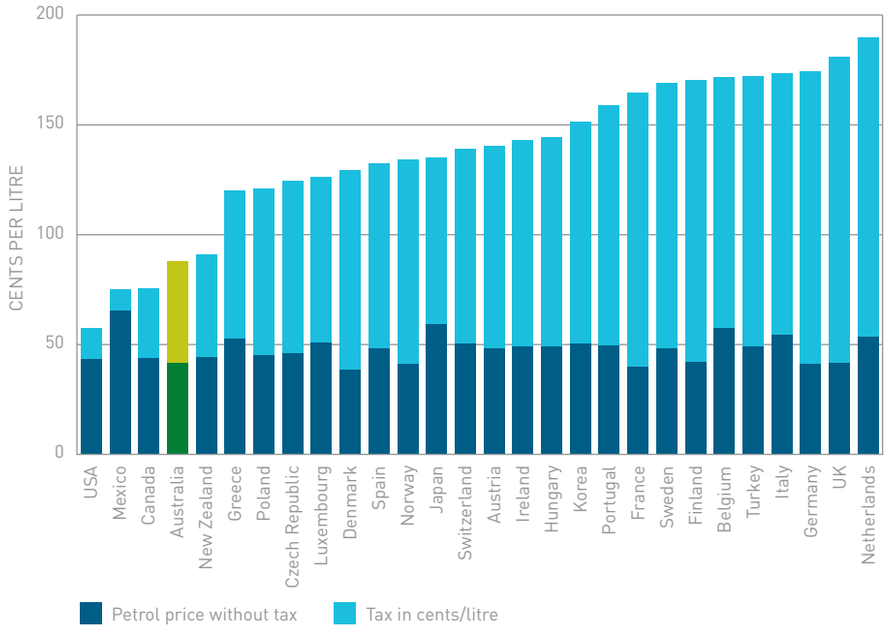
Figure 2: Flow diagram of petroleum supplies, 2004–05, in petajoules



Source: ABARE 2004

The market for petroleum fuels in Australia has been highly competitive and consumers have benefited by receiving relatively low prices. Australian petrol prices have been amongst the lowest in OECD nations, reflecting the efficiency and level of competition in the local and regional markets and the relatively low rate of fuel excise in Australia (IEA 2004)[ii]. Fluctuations in world oil prices, of course, will also impact on Australian petrol prices.

Figure 3: Petrol Prices in OECD Countries including tax, December Quarter 2003



Source: International Energy Agency, 2004

The downstream petroleum sector in Australia comprises domestic refineries, wholesalers (including importers), distributors and retailers, and encompasses the conversion of crude oil into final products, and the distribution and sale of those products to consumers. Like most industries, Australia's downstream petroleum sector has undergone a period of substantial change over the last 20 years. Refinery closures have reduced the number of operating refineries from 10 to 7, and the number of retail sites has fallen from around 20 000 in 1970 to less than 8000 today. Until recently, returns in both the refining and retail sectors have been low for a long period, and pressure for restructuring remains a feature in the market.

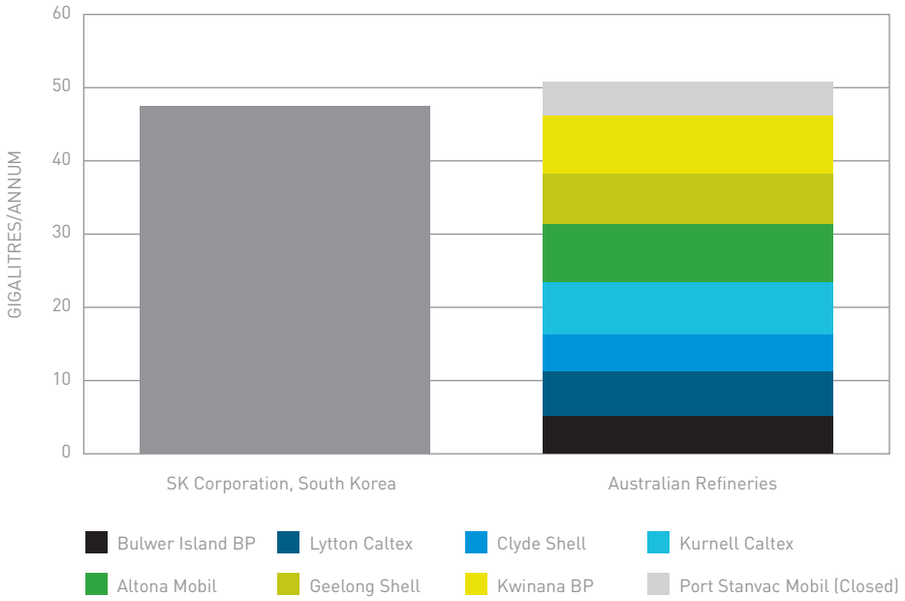
The future structure of the Australian downstream petroleum sector will depend on a range of factors including: Australia's relative attractiveness as a location for refining and retail sector investment; international and domestic market demand and capacity; the extent of competition from importers, wholesalers and independent retailers; the commercial viability of alternative transport fuels; and the impact of new mandated fuel standards.

REFINERIES

Investment in oil refineries worldwide is cyclical. Investment tends to occur at the same time in the same region as refiners compete for projected sales growth, or seek to limit potential losses if operations are not upgraded to meet demands for improved product quality. This cyclical investment pattern has led to periods of over-capacity and low margins worldwide.

The Australian refining industry operates in an internationally competitive market, with large refinery capacity existing in South-East Asia capable of exporting substantial volumes of fuel into Australia. Australian refineries are small in capacity compared with new refineries in Asia. For example, the largest Asian refinery at Ulsan in South Korea could supply Australia's entire yearly fuel demand. The threat of imports has been an important factor in providing Australia with competitively priced fuels, although Asian refiners face additional transport costs to supply Australian markets.

Figure 4: Indicative refinery capacity



Source: Australian Institute of Petroleum

Until recently, rates of return in the Australian refinery sector had been very low, with an average rate of return for the industry of 3.7 per cent in the five years to 2001 (Ernst and Young 2001). These low rates of return coincided with significant over-capacity in the Asia-Pacific region and created pressure for restructuring, such as the mothballing of Mobil's Port Stanvac refinery near Adelaide in July 2003.

From late 2003 the Australian refining industry has improved its financial performance as refinery margins in Asia increased due to higher demand in China and the United States. However, the improved refinery margins in Asia mean that the relative attractiveness of investing in the Australian refining sector may not have improved. This remains an issue for refineries needing to make significant investments to meet new mandatory clean fuel standards. It has been estimated that the first tranche of clean fuel standards to 2006 will require an investment by the refining industry in Australia of up to $1 billion (AIP 2003). While a significant portion of this investment has been made or committed by some refiners, others have yet to indicate their intentions.

WHOLESALERS/DISTRIBUTORS & RETAILERS

The wholesale and retail marketers of fuels in Australia are continually having to evolve in order to meet the challenges presented by new entrants, new and more efficient business structures, competition from non-traditional players and changing fuel needs. Petroleum marketing is a high-volume, low-margin business with discounting cycles involving substantial competition.

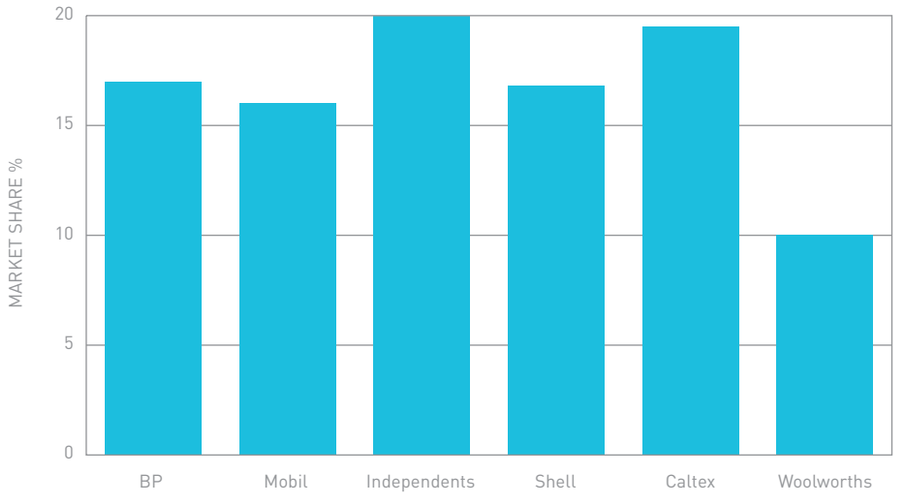
While the international oil market plays a primary role in determining average petrol prices in Australia, local retailers also set prices in response to local levels of competition. Service station operators sometimes discount petrol prices to attract more customers, accepting lower profits on fuel sales but seeking increasing sales of non-fuel items, such as retail goods. Their competitors usually react by similarly reducing their petrol prices. As petrol prices fall, some service station operators receive price support from their wholesaler. In periods of heavy discounting, petrol may be sold at a loss; however, this is not sustainable and eventually the discounting stops. Service station operators then put their prices up again, usually returning to earlier levels (about 3 to 4 cents per litre above the wholesale price) and the pricing cycle recommences. Petrol prices can fluctuate by 10 cents per litre in one day in particularly competitive markets. The Australian Competition and Consumer Commission (ACCC) examined reducing fuel price variability in 2001 and stated that it is likely that consumers in aggregate benefit from price cycles (ACCC 2001). The ACCC has initiated a consumer awareness campaign to enable consumers to buy their petrol at times when petrol prices are relatively low.

A range of distributors in Australia have been consolidated by refiner/marketers where they held majority equity, resulting in single distribution networks serving an entire state. Having well established wholesale and distribution networks has improved efficiency and the consistency of output from refineries to retail sites. Consequently, the number of independent wholesalers and distributors operating in the market has reduced dramatically. Furthermore, most independent retailers, comprising about 20 per cent of the retail market, source at least 50 per cent of their fuel from the refiner/marketers.

The advent of supermarkets into fuel retailing arrangements will play a major role in the Australian market for transport fuels. Recent significant changes have included the establishment and expansion of the Woolworths network, now being progressed through a co-branding arrangement with Caltex, and an alliance between Coles Myer and Shell. Both these alliances offer grocery customers access to petrol discounts. The ACCC conducted an extensive review of the tying of petrol discounts to grocery sales by both Coles Myer and Woolworths and announced on 6 February 2004 that the introduction of the shopper docket schemes has encouraged competition and lower prices in the fuel market (ACCC 2004).

Supermarkets have been part of the United Kingdom and French retail fuel markets for over 10 years. While supermarkets have been successful in capturing significant market shares, the markets in those countries have remained competitive in delivering petroleum products to consumers from a range of oil major, supermarket and independent sites.

Figure 5: Retail market share, 2003



Note: 2003 data which predates market changes over the last 12 months
Source: IBIS World Australia, Automotive fuel retailing in Australia, 2004

MARKET REGULATION

The dynamics of the downstream petroleum market emphasise the importance of ensuring arrangements exist which promote effective and fair competition.

At the Commonwealth level, the Petroleum Retail Marketing Sites Act 1980 and the merger provisions of the Trade Practices Act 1974 have a direct influence over ownership arrangements in the sector. The Trade Practices Act 1974, which now incorporates prices surveillance powers under Part VIIA and the Petroleum Retail Marketing Franchise Act 1980 also regulate, or potentially regulate, conduct by market participants. At the state and territory level, there are wide variations in the degree of regulation over such matters as price variability and terminal gate pricing, as well as environmental, consumer protection, and occupational health and safety. Local governments play a role in approval of sites and remediation requirements.

Since 1983, there have been at least 43 inquiries into petrol pricing in Australia, and none of these has found evidence of profiteering by petroleum marketers. The ACCC currently informally monitors petrol, diesel and auto liquefied petroleum gas (LPG) prices at around 4000 sites across Australia. This arrangement provides confidence that Australia will continue to enjoy competitively priced fuel.

The extent and complexity of the Petroleum Retail Marketing Sites Act 1980 and Petroleum Retail Marketing Franchise Act 1980 have the potential to deter investment in the marketing of transport fuels. The Australian Government believes there would be benefit in greater cooperation between jurisdictions and the adoption of a whole-of-government approach to regulation that recognises the national nature of the downstream petroleum sector.

The Australian Government prefers a light-handed but appropriate approach to regulation that recognises market forces as the most effective mechanism for determining resource allocation and prices. However, the government believes that reform of the downstream petroleum market is needed and has developed a comprehensive reform package encompassing a national approach to terminal gate pricing, a mandatory code of conduct governing relations between fuel suppliers and retailers (the Oilcode) and the repeal of the Sites Act and the Franchise Act. The Australian Government looks forward to broad industry support for these reforms.

THE ROLE OF FUEL STANDARDS

National fuel standards are set under the Fuel Quality Standards Act 2000 to regulate the level of pollutants and emissions arising from fuel use, facilitate the adoption of more efficient engine and emission control technology, and allow the effective operation of engines.

The Australian Government has implemented processes for setting fuel quality standards with the aim of broadly aligning Australian fuel quality parameters with international standards. The first tranche of Australian standards for petrol and diesel is being progressively introduced between 1 January 2002 and 2006. A second tranche of Australian standards was forecast in the 2003–04 Budget. They will bring national petrol and diesel standards into approximate alignment with the European (Euro 5) standards for both fuels, to be introduced in Europe on 1 January 2009.

Australian refiners and fuel importers have been provided by the government with a clear policy and regulatory framework to supply high-quality (low-sulphur) fuels. The government has provided incentives to refiners and importers to offset the higher costs of producing cleaner fuels and to bring forward supplies of 50 ppm sulphur diesel in advance of the mandated date of 1 January 2006 to capture early environmental benefits. Forty per cent of the diesel fuel market will be supplied with 50 ppm sulphur diesel by June 2004. A second phase of incentives will encourage the early supply of 50 ppm sulphur premium unleaded petrol and 10 ppm sulphur diesel two years before the mandated dates for these fuels (currently anticipated to be 1 January 2008 and 1 January 2009 respectively).

The second phase of incentives, including the additional excise rates required to fund the proposal, will be reviewed in the period prior to implementation to ensure that it aligns with the timing of new fuel standards and market conditions. The indicative excise (and customs) duty increase would be 0.7 cents per litre on all diesel and 0.06 cents per litre on all petrol, in order to fund subsidies for the increased production costs of 1.0 cents per litre for 10 ppm sulphur diesel and 1.1 cents per litre for 50 ppm sulphur premium unleaded petrol.

In determining fuel standards, the Australian Government also carefully considers the potential impact on competition in fuel markets. The movement of Australian fuel standards away from those applying more generally in the Asian region can have an impact on the availability of competitively priced imports. A recent example of this was the reduction in the permitted level of olefins in petrol and the effective prohibition of the additive, methyl tertiary butyl ether (MTBE), from petrol in Australia from 1 January 2004. Petrol meeting these standards can be supplied from Asia but it is not as widely available as petrol containing a higher volume of olefins and/or MTBE, and it commands a small price premium (consistent with cleaner fuels costing more to produce). These impacts were anticipated by the Australian Government when it set the standards in 2001.

While fuel standards in many Asian nations are currently less stringent than in Europe and North America, these markets are also expected to move towards common standards over time, albeit at a somewhat slower rate than anticipated to occur in Australia (Hart, 2003).

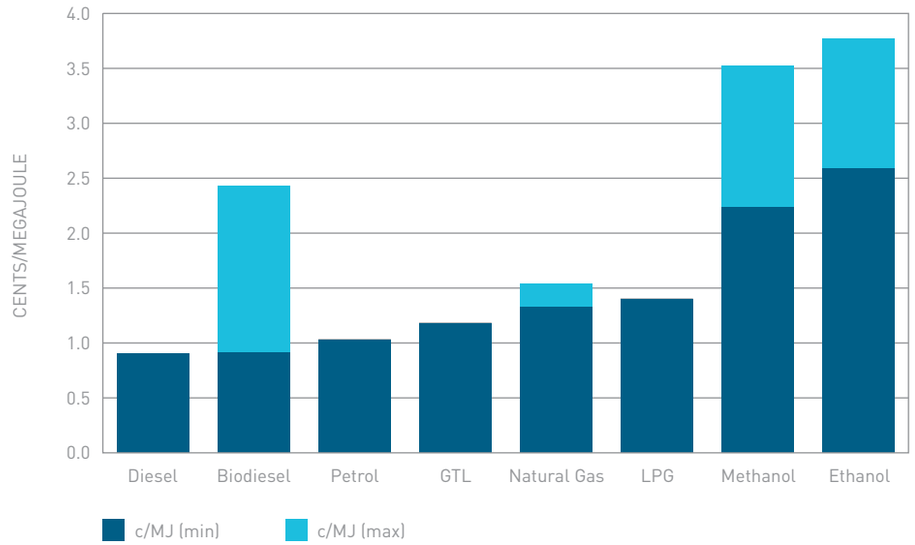
The Australian Government recognises that in the determination of future fuel standards there is a need to balance environmental objectives with competition and industry objectives. Accordingly, it will continue to consult closely with stakeholders on these matters. The government is also committed to integrating its policy approach on the refining and vehicle industries with regard to air quality objectives, in recognition of the relationship between the capacity of auto manufacturers to meet emission standards and the capacity of refiners to meet fuel quality.

ALTERNATIVE FUELS

The main alternative fuels currently being used in Australia are LPG, natural gas and biofuels such as ethanol and biodiesel. Other potential alternative fuels include hydrogen, di-methyl ether and methanol. LPG is a petroleum fuel and currently supplies about 6 per cent of transport fuel requirements by volume (DITR 2004), or about 5 per cent by energy content (ABARE 2003). Other alternative fuels in total contribute less than 1 per cent by either volume or energy content.

The government has implemented a framework of measures to support the use and production of alternative fuels in Australia. These measures include excise concessions currently estimated to cost $840 million a year in foregone excise revenue (mostly from LPG sales), a $1000 grant for LPG vehicles delivered new from 1 July 2011 (available until 30 June 2014), a $37.6 million capital fund to support new biofuels production capacity, and measures to bolster confidence in the use of ethanol petrol blends.

Figure 6: Indicative energy costs of transport fuels (net of tax)



Source: Australian Government estimates
Note: Prices of petroleum fuels vary with international oil prices and exchange rates. Minimum and maximum prices for biofuels and natural gas–sourced fuels reflect large variations in feedstock prices and/or throughput volumes. Based on an oil price of US$35 per barrel and an exchange rate of A$1 = US70cents.

No effective excise will apply to currently untaxed alternative fuels until 1 July 2011. Effective excise will then be introduced in five equal annual steps to a final rate on 1 July 2015. The phased introduction of excise recognises the need for effective transitional arrangements to give fuels that are currently effectively untaxed an opportunity to establish their place in the market. Alternative fuels entering the excise net will also receive a discount of 50 per cent on the full energy content excise rate.

The government's approach to biofuels reflects the regional and other benefits that would arise from the development of a commercially viable industry in Australia while recognising that all fuels need to be able to compete on their commercial merits in the longer term. The Australian Bureau of Agricultural and Resource Economics has examined the assistance currently provided by the Australian Government for the biofuels industry and has reported that it would support the further development of the industry (ABARE 2004).

The Australian Government has provided a generous policy framework for the alternative fuels sector to develop and promote their products in the commercial marketplace. Ultimately these fuels must compete on their commercial merits and the government will not mandate the use of alternative transport fuels.

LOOKING FORWARD

The Australian Government is committed to providing a policy framework that will allow the downstream petroleum sector to reliably supply competitively priced, clean fuels to meet Australia's growing transport fuel needs. Within that framework, the government also seeks a strong, environmentally responsible domestic refining industry capable of playing a primary role in supplying Australia's refined petroleum product needs at competitive prices.

5

FUEL EXCISE REFORM

Key Points

The current excise arrangements are no longer consistent with the principles of good taxation.

The Australian Government will implement a major programme of reform to modernise and simplify the fuel excise system, commencing on 1 July 2006 and concluding on 1 July 2015. The changes will lower compliance costs, reduce tax on business and remove the burden of excise from thousands of individual businesses and households.

The government will limit the effective application of excise to:

- business use of fuel in on-road applications in vehicles with a gross vehicle mass of less than 4.5 tonnes
- private use of fuel in vehicles and certain off-road applications

All fuels used off-road for all business purposes will become excise-free over time.

Excise rates for all fuels will be based on energy content, with alternative fuels receiving a 50 per cent discount on energy content excise rates.

The current complex system of grants and rebates will be replaced by a single business credit system. Excise credits will be claimable through the Business Activity Statement from 1 July 2006.

Partial excise credits will apply to all fuels, including petrol, used for all business purposes on-road in vehicles with a gross vehicle mass of at least 4.5 tonnes.

The net excise paid on fuels used on-road for business purposes in heavy vehicles (those with a gross vehicle mass of 4.5 tonnes or more) will be converted into a road user charge, and the urban-regional boundaries that govern eligibility for excise credits for heavy vehicles will be removed. New requirements will be introduced to address heavy polluters.

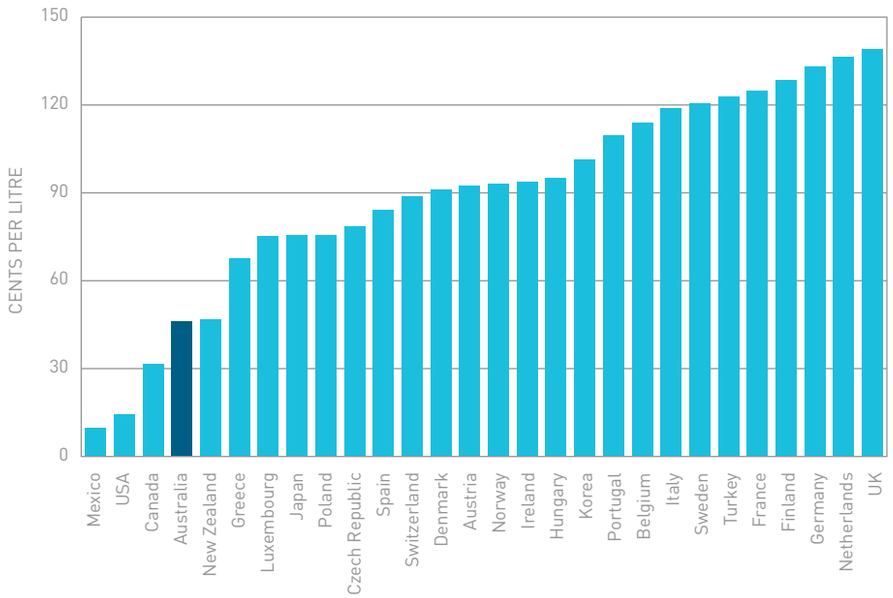
The Petroleum Products Freight Subsidy Scheme will cease and funds from the Fuel Sales Grants Scheme will be redirected to improve transport infrastructure for regional and outer-metropolitan areas as part of the AusLink strategy.

INTRODUCTION

All OECD countries impose some level of excise on transport fuels. Australia is no different, with fuel excise providing an important source of revenue for the government. Australia collects about $13 billion annually from fuel excise—that is, about 7 per cent of total revenue. Of this, around $4 billion is currently returned, predominantly to businesses but also to some households, in the form of credits, rebates and subsidies.

Australian taxes on fuel are low by world standards. Australia's tax on petrol is the fourth lowest of 28 OECD countries measured in terms of cents per litre, and fifth lowest measured as a percentage of the fuel price. Australia's tax on diesel is the fifth lowest on the basis of cents per litre, and the sixth lowest on the basis of the percentage of the price of fuel. The relative burden of excise will continue to fall because of the government's decision in 2001 to remove indexation of excise rates.

Figure 1: Taxation on petrol in cents per litre for selected OECD countries



Source: International Energy Agency, **Energy prices and taxes: quarterly statistics**, first quarter 2004 edition (December quarter 2003 data)

While imposing a relatively low burden overall, Australia's fuel excise regime is in need of reform. The current system has a number of inconsistencies and anomalies. The result has been an inefficient system that imposes unnecessary costs on business and households. For example:

- Users of fuel for business purposes on-road in heavy diesel vehicles outside of metropolitan areas presently incur excise at an effective rate of 19.633 cents per litre, whereas equivalent users with heavy petrol vehicles pay 38.143 cents per litre.
- Business users of diesel for quarrying limestone used on farms to prepare soil for cultivation effectively incur no excise, whereas those quarrying for limestone used in making cement incur excise on their diesel at 38.143 cents per litre.
- Households not connected to the grid using burner fuels for heating pay fuel excise of 7.557 cents per litre, whereas households connected to the grid using electricity do not pay excise for heating.

The Australian Government will implement a major programme of reform to modernise and simplify the fuel excise system. The changes will remove the burden of excise from thousands of businesses and households, and will provide Australia with a fuel excise system better suited to the needs of the 21st century. The changes represent the first comprehensive reform of the system since its inception.

In developing the reforms, the government has been guided by a view that, to the greatest extent practical, the fuel excise system should:

- apply in a consistent and transparent way to all relevant fuels and fuel users
- be competitively neutral, avoiding instances where taxed fuels compete with untaxed fuels
- minimise tax on business inputs
- minimise compliance and administration costs for business and government
- take account of the government's environmental, social and fiscal objectives

The reforms will be phased in commencing 1 July 2006, with the final changes being made on 1 July 2015. This timeframe ensures that those affected by the changes have time to adjust, and introduces substantial new relief from the effect of fuel tax in a fiscally responsible way. The reforms will not affect arrangements for aviation fuels.

EXCISE ON ALTERNATIVE FUELS

The government announced arrangements for applying excise to all fuels used in an internal combustion engine (noting that the intention is to target transport applications) on 16 December 2003. Excise has historically been applied to specific fuels. This has resulted in taxed fuels competing with untaxed fuels, which harms economic efficiency. The arrangements included a move to excise rates being based on the energy content of fuels, using a banded system. Generous transition provisions were established and a 50 per cent discount provided for alternative fuels.

The transition arrangements announced by the government have been extended to provide more time for existing fuel producers and users to adjust, including the liquefied petroleum gas (LPG) industry, and for new transport fuels—like biofuels, compressed natural gas (CNG) and liquefied natural gas (LNG)—to establish their credentials in the marketplace. Effective excise on new fuels will phase in over five even annual steps commencing on 1 July 2011. A discount of 50 per cent to the energy content excise rate will apply to these fuels. This discount was set having regard to a range of industry, regional and other factors.

Table 1: Excise rates

Fuel type	Energy content (megajoules/litre)	Excise rate (cents/litre)	Discount rate
High-energy content fuels: petrol, diesel, gas to liquids, diesel, biodiesel	Above 30	38.143	19.1 (biodiesel)
Mid-energy content fuels: liquefied petroleum gas, liquefied natural gas, ethanol, dimethyl ether	Between 20 and 30	25.0	12.5 (all)
Low-energy content fuels: methanol	Below 20	17.0	8.5 (methanol)
Other: compressed natural gas	Between 38 and 41 (megajoules per cubic metre)	38.0 (cents per cubic metre)	19.0 (cents per cubic metre)

FUEL EXCISE RELIEF FOR BUSINESS AND HOUSEHOLDS

Further reforms will be introduced to make the fuel excise system simpler for business and to substantially lower the excise burden on business and households. The current complex system of grants and rebates will be replaced. The fuel excise reforms will effectively reduce fuel excise collections from businesses and households by about $100 million in 2006–07, $350 million in 2008–09 and $310 million in 2012–13, totalling about $1.5 billion over the whole period.

The changes reflect a refocusing of the excise system away from specific fuels, and towards types of activities. They also reflect a determined effort to reduce the burden of excise and compliance on business. Ultimately, the government's intention is for excise to be limited to:

- business use of fuel in on-road applications in vehicles with a gross vehicle mass of less than 4.5 tonnes
- private use of fuel in vehicles and certain off-road applications.

The 4.5 tonne gross vehicle mass cut-off was chosen because:

- it reflects an existing break-point in the fuel taxation system
- additional licensing conditions must be met in all Australian jurisdictions to drive a vehicle of this mass or greater
- it is more difficult to distinguish between private and business use in small vehicles.

Under the reforms, the burden of excise will be removed entirely from businesses using fuel in off-road applications, including in the commercial generation of electricity for domestic applications, such as heating. To achieve this, the government will introduce a mixture of excise exemptions and excise credits. A new business credit system will be introduced, which will replace all rebates and concessions.

Business use of fuels off-road

A full excise credit will be introduced for all business use of fuel off-road. This measure will be phased in for newly eligible activities, with a 50 per cent credit being provided from 1 July 2008 and a full credit from 1 July 2012. Credits will apply to all taxable fuels, including petrol.

The change will benefit tens of thousands of businesses across a wide range of industries. Confusing and artificial boundaries between eligible and non-eligible activities will be removed. This will benefit many existing recipients of excise relief, who will gain additional excise relief and will no longer be required to make complex calculations to determine whether they are eligible for a rebate. Primary producers and mining businesses will particularly benefit from this.

Excise relief will also be provided to a range of activities for the first time. Manufacturing, quarrying[1] and construction businesses will become eligible for credits for fuel used off-road, and will maintain their eligibility for credits for fuel used on-road in heavy vehicles. This will lower costs for these businesses and should translate into lower prices for consumers.

Table 2: Off-road excise reform—Additional eligible activities

Examples of additional activities	
→ Drying of crops/grain after harvest	→ Residences and business heating
→ Vehicles under 3.5 tonnes used off-road for business purposes - petrol utes - quad motorcycles	→ Quarrying and extractive industries
→ Petrol used by business off-road	→ Fuel used to maintain municipal sportsgrounds, golf courses
→ Off-road transport of livestock	→ Civil construction and earth-moving activities
→ Diesel used for commercial electricity generation	→ Fuel used in the moving and handling of goods prior to transport (e.g. fuel used to load and unload a train)

Local, state and territory governments will also benefit significantly, with excise credits being provided for fuels used in a range of government activities. For example, state and territory governments and statutory bodies will gain from the extension of excise credits for fuel used in constructing infrastructure, large-scale electricity generation and water supply, and conservation activities. Local governments will gain from the extension of the full excise credit for fuel used in the maintenance of municipal sportsgrounds, gardens or golf courses, amenity horticulture (e.g. growing of flowers/trees in parks and playgrounds) and local public works activities (e.g. road construction).

Fuel used in power generation

Fuels used in power generation are not treated equally under the current excise system, with diesel and fuel oil facing excise. The excise on these fuels increases the cost of producing power for both business and households, particularly in remote locations without access to the electricity grid where there is no cost-effective alternative available.

1. Some existing quarrying activities receive excise credits. For example, diesel used for quarrying limestone used on farms to prepare soil for cultivation effectively incurs no excise.

To address this, effective excise on fuels used for power generation will be removed from 1 July 2006. This approach ensures that all fuels used in power generation are treated equally, and will remove an excise burden of about $140 million.

There will be no effective excise on currently untaxed fuels used for power generation.

Fuels used for heating

Up to 90 000 Australian households, mainly in regional areas, pay excise on the fuel they use for heating, and this is simply unfair. Most Australians do not pay excise on the fuel they use for heating, as they rely on electricity and gas from the grid. The 7.557 cent per litre excise on burner fuels (like heating oil and kerosene) imposes an unreasonable burden on households that use burner fuels and will be removed from 1 July 2006. The removal of this excise will also benefit many businesses, which use these fuels in industrial applications. Excise will apply to these fuels when used in a transport vehicle.

SUPPORTING THE ROAD TRANSPORT TASK

The government will support better land transport through AusLink, which will improve Australia's transport infrastructure network, and through the measures contained in this Energy White Paper. In combination, these two packages will greatly improve the efficiency of Australia's land transport.

In total, the government is allocating $11.8 billion for road and rail transport over the five years to 2008–09. This includes:

- → $7.7 billion in land transport funding for the AusLink National Network
- → $1.45 billion for the Roads to Recovery programme
- → $2.55 billion for Financial Assistance Grants for roads
- → $90 million for the National Black Spot programme

AusLink's core components are:

- → a defined National Land Transport Network of important national road and rail infrastructure links and their intermodal connections
- → the National Land Transport Plan, which outlines the government's investment decisions to improve and integrate the National Land Transport Network
- → a single funding regime for the National Land Transport Network
- → support for local and regional transport improvement
- → new legislative, intergovernmental, institutional and programme mechanisms

Road user charge

The transport sector has long argued that the current excise arrangements for heavy vehicles, defined as those with a gross vehicle mass of 4.5 tonnes or more, are inefficient and need reform. The government has listened and will introduce reforms to remove inefficiencies and ensure the excise system plays a more positive role in supporting Australia's transport task.

The existing partial excise applying to fuel used in heavy vehicles will be formally recognised and set as a non-hypothecated road user charge from 1 July 2006. The value of the charge will be set in accordance with the National Transport Commission's heavy vehicle charging determination process. This cooperative federal–state process assesses the impact of heavy vehicles on road costs, and is used by the states and territories to set and adjust registration charges for these vehicles. The excise-based charge will be adjusted annually in the way that the states and territories adjust registration fees. Changes to the charge will be made by varying the level of effective excise through adjustments in the level of the excise credit paid for fuel used in heavy vehicles.

Urban–regional boundaries

The existing urban–regional boundaries that govern eligibility for excise credits for heavy vehicles will be removed on 1 July 2006. These boundaries were put in place to try to reduce emissions from heavy diesel vehicles in city areas. The government is introducing a new measure that will more effectively and directly achieve this objective, while reducing costs for transport operators. These costs ultimately increase the price paid by consumers for transported products.

Removal of the urban–regional boundaries will facilitate a major reduction in compliance costs for many businesses by removing a legal impediment to the introduction of a single comprehensive business credit regime.

Excise relief for all fuels

The excise arrangements for heavy vehicles will apply to all fuels, not just diesel. In the case of petrol, introduction of the road user charge on 1 July 2006 will provide partial excise relief for around 54 000 heavy petrol vehicles for the first time (ABS 2003). This is consistent with the principles of competitive neutrality.

Road funding

As part of AusLink, the government announced an additional commitment of $565 million in 2006–07 (more than $2 billion over four years from 2005–06) to improving transport infrastructure, particularly in regional and outer-metropolitan areas.

The package includes the continuation of the Roads to Recovery programme and the redirection of funds from the Fuel Sales Grant Scheme from 1 July 2006 to improve

transport infrastructure for regional and outer-metropolitan areas. A review of the Fuel Sales Grant Scheme (conducted by the Fuel Tax Inquiry) concluded that it was difficult to identify the benefits of the scheme to consumers in rural and remote areas and that significant boundary anomalies were encountered under it. The Petroleum Products Freight Subsidy Scheme will remain in place until 30 June 2006 and then cease.

REDUCING THE COMPLIANCE BURDEN ON BUSINESS

Reducing the compliance burden imposed by the excise and energy grants systems is a key priority for the government. The complex eligibility criteria and ad hoc requirements of the existing grants system impose a substantial compliance burden which adds to business costs and harms competitiveness.

When fully implemented, the business credit reform will free business from the onerous task of estimating fuel use in various activities according to restrictive and complex criteria. This will lead to a significant reduction in record keeping required to substantiate entitlements.

To achieve this, the government will introduce a single business credit system that will be claimable through the Business Activity Statement in the same way as GST credits from 1 July 2006. Business interactions with the Australian Taxation Office (ATO) will also be simplified and reduced as they will have a single point of ATO contact and the necessity of separate credit claim forms will be removed. This will make it easier for businesses to keep the records needed to substantiate their entitlements.

Businesses will also no longer need to clarify complex eligibility criteria, including through costly and time-consuming litigation. For example, last year alone, there were 90 cases subject to litigation (with 76 cases unresolved as at the end of 2003) relating to the eligibility criteria for business credits for fuel used in off-road activities. There will also be substantial administrative benefits because the ATO will be able to streamline claims processing and payments.

These changes build upon the measures to assist small business by simplifying taxation and reducing their compliance burden announced in the 2004–05 Budget.

The start date of 1 July 2006 allows for extensive consultation with industry on implementation of the reforms. For compliance reasons, there may be instances where it will be necessary to impose excise on fuels used in non-vehicle applications and then provide credits to make the use of fuels in non-vehicle applications effectively excise-free. The taxing point arrangements for fuels when used in non-vehicle applications will be determined following industry consultation. The 1 July 2006 start date also allows time for this consultation and for industry adjustment to the new arrangements.

EXCISE REFORM TIMETABLE

1 July 2006 Excise on burner fuels will be removed.

A full credit will be provided for all fuels used in power generation.

Excise on heavy vehicles will be converted to a road user charge. Excise relief will be provided for petrol and all other taxable fuels used for business purposes in heavy vehicles.

Urban–regional boundaries will be removed.

Spending under the Fuel Sales Grants Scheme will be converted to road funding.

The Petroleum Products Freight Subsidy Scheme will end.

Access to excise credits for those claiming more than $3 million per year will be linked to participation in the Greenhouse Challenge programme.

Access to on-road credits for heavy diesel vehicles will be linked with meeting one of five emissions performance criteria designed to ensure vehicles meet the emission standard set under the Diesel National Environment Protection Measure.

1 July 2008 A 50 per cent credit will be introduced for the off-road business use of taxable fuels in activities not previously eligible for credits.

1 July 2011 Effective excise will apply to all fuels used in an internal combustion engine, including concessional excise for biodiesel, ethanol, liquefied petroleum gas, liquefied natural gas and compressed natural gas. The effective excise rates will increase over five equal annual steps, reaching their final rates on 1 July 2015.

1 July 2012 Full credit will be extended to all business use of all taxable fuels in all off-road activities.

1 July 2015 Final effective fuel excise rates will apply to all taxable fuels, including a 50 per cent discount for alternative fuels.

MEETING ENVIRONMENTAL RESPONSIBILITIES

The government has a comprehensive regime in place for addressing the environmental impact of fuel use (see Chapter 9, Energy and the environment). This regime targets the use of petrol and diesel, which are the main fuels used in Australia. A generous regime is also in place for the development of alternative transport fuels (see Chapter 4, Energy markets—Delivering Australia's transport fuel needs), noting that the environmental benefits of these fuels are limited and do not on their own justify significant ongoing support. To supplement these measures, the government will introduce two new measures designed to ensure that those receiving significant excise benefits meet appropriate environmental standards.

Conditional excise credits for large energy users

From 1 July 2006, businesses receiving fuel excise credits of more than $3 million per year will be required to be members of the Greenhouse Challenge programme. As members of Greenhouse Challenge, credit recipients will measure their greenhouse emissions, develop possible options for abatement and report on progress.

This measure will encourage the prudent management of energy use by significant users such as large mining and transport companies. The government recognises that making greenhouse management a core element of business is important to finding cost-effective solutions to the long-term greenhouse response. The measure signals an expectation that large energy users will participate in an active partnership with government to address climate change, and complements the government's other energy and greenhouse gas abatement measures addressing large energy users.

Conditional excise credits for heavy diesel vehicles

The government will establish new requirements to encourage the owners and operators of high-emitting heavy diesel vehicles to reduce exhaust emissions of particulates, smoke and smog-forming pollutants to acceptable levels.

Australian cities generally have good air quality but the localised impact on air quality and community health of a relatively small number of older or poorly maintained diesel vehicles remains an important issue. Repairing these vehicles can reduce their emission of particulates—the most dangerous emission to human health—by up to 45 per cent.

Starting from 1 July 2006, users of heavy diesel trucks and buses will need to meet one of the following five emissions performance criteria that establish that the vehicle is not likely to be a high polluter to be eligible for excise credits as part of the road user charging arrangements:

- all vehicles manufactured since 1 January 1996
- vehicles that are part of an accredited audited maintenance programme
- vehicles that pass the in-service emission standard set by the Australian Transport Council and referred to in the National Environment Protection (Diesel Vehicle Emissions) Measure agreed in 2001 between the Australian Government and all state and territory governments
- vehicles which comply with a simple Australian government–endorsed maintenance schedule that includes an emissions component, which will be developed in consultation with the transport industry
- vehicles owned by primary producers that are used in their owners' primary production business activity.

The first four criteria are designed to ensure that the operators of diesel vehicles have an incentive to make sure the vehicles meet the emission standard set under the Diesel National Environment Protection Measure. The fifth is designed to exempt farm vehicles, as these vehicles do not generally contribute to urban air quality problems.

Conditional excise credits for heavy diesel vehicles will replace the urban–regional boundary system. This measure will target emissions from heavy diesel vehicles more effectively, whilst imposing a lower compliance burden on business.

LOOKING FORWARD

The government's reforms will provide Australia with a fuel excise system suited to the needs of the 21st century. It will provide a system that delivers excise relief for many thousands of businesses and households, and complements the government's broader business tax changes. It does this in a way that will lower the compliance burden for business.

6

ENERGY EFFICIENCY

Key Points

- Increasing the uptake of commercial energy efficiency opportunities could increase GDP by $975 million a year and significantly reduce greenhouse gas emissions.
- Energy efficiency is, and will remain, a central element of a cost-effective greenhouse abatement strategy, delivering about 40 per cent of expected energy sector abatement in 2010.
- Australia's energy efficiency performance has not been as strong as other nations. Improving this performance is a high priority for government.
- To improve Australia's energy efficiency performance, the Australian Government will
  - improve price signals for demand side management as part of reforming Australia's energy markets
  - demonstrate the potential benefits of energy efficiency and market reform through major Solar Cities trials
  - expand the range of appliances and buildings subject to minimum energy performance standards
  - continue to improve the energy efficiency of Australian Government agencies
  - increase the availability of information on the energy performance of appliances, buildings and vehicles
  - require large energy users to regularly identify and publicly report on energy efficiency opportunities
  - streamline energy reporting requirements and participation in energy efficiency and greenhouse programmes using the Greenhouse Challenge programme as a single point of entry.
- A Productivity Commission inquiry will be established to provide further information on the potential benefits of, and policies to achieve, improved energy efficiency.
- The government will continue to work cooperatively with the states and territories on energy efficiency through the National Framework for Energy Efficiency process.

INTRODUCTION

Improving Australia's uptake of commercial energy efficiency opportunities has the potential to increase economic welfare and lower the rate of growth in greenhouse emissions. Increased energy efficiency reduces overall demand for energy and would also delay the need for new energy generation equipment.

Energy efficiency has played an important role in Australia's efforts to reduce greenhouse emissions. About 40 per cent of greenhouse abatement from the Australian energy sector expected by 2010 is from energy efficiency measures.

WHAT IS ENERGY EFFICIENCY?

Energy efficiency refers to gaining the same or a higher level of useful output, using less energy input. Energy efficiency is important in both stationary and transport energy.

Technical energy efficiency is energy efficiency that comes from new and improved technologies and equipment (e.g. energy-saving appliances, cogeneration in industrial applications) or operational practices (e.g. energy-efficient design of industrial plant or just switching off lights and equipment when not in use).

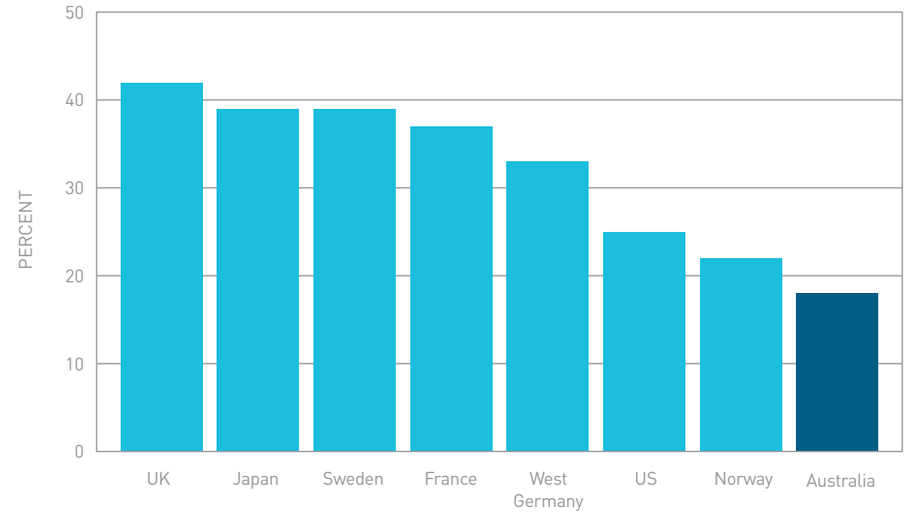
Energy intensity measures the energy used to produce a certain outcome, whether it be a widget or GDP. Improved technical energy efficiency will lead to a lower energy intensity, all other things being unchanged.

However, other things do change. Other sources of changes in energy efficiency are **structural** and **fuel use effects**. For example, Australia is becoming focused more on services and less on manufacturing. Since manufacturing is usually more energy-intensive, these structural changes will lead to improved economy-wide energy efficiency. Changes in **fuel use** can also lead to changes in energy efficiency as the technologies to use fuels differ in their conversion efficiencies.

AUSTRALIA'S ENERGY EFFICIENCY PERFORMANCE

Energy efficiency improvements in Australia have occurred more slowly than in other nations. Over the period from 1973–74 to 2000–01, technical energy efficiency (see Box—What is energy efficiency?) in Australia improved by 3 per cent. The International Energy Agency has found that Australia's energy efficiency has improved at less than half the rate of other countries. (IEA, 2001b)

Figure 1: Manufacturing energy intensity improvement, 1973–95



Source: International Energy Agency, Energy use in Australia in an International perspective, 2001

Australia's performance needs to be placed into context. Investments in energy efficiency increase economic welfare only when they replace less productive investment or meet commercial return benchmarks. As an environmental measure, increased energy efficiency needs to represent a lower-cost solution than alternatives before becoming attractive. That said, energy efficiency has consistently proved the most cost-effective of Australia's responses to greenhouse emissions.

Lower energy prices in Australia are one factor driving our poor energy efficiency performance. Lower energy prices reduce the commercial attractiveness of some energy efficiency opportunities, making it less likely (or rational) for individuals or businesses to pursue. It is not the only factor, however, as countries with similar energy prices (like the United States and Canada) have experienced higher growth in energy efficiency than Australia.

Considerable evidence exists that impediments are preventing the optimal uptake of energy efficiency in Australia. These impediments include:

- price signals and market arrangements that do not fully value the benefits from energy efficiency (either as a mechanism for addressing greenhouse emissions or reducing energy demand in response to higher prices)
- arrangements where energy users do not control their own costs, and have little incentive to manage energy use effectively
- a lack of information about energy efficiency opportunities and cultural barriers within firms, resulting in decision makers being unaware of potential commercial opportunities.

SCOPE AND BENEFITS

Energy users currently spend around $50 billion annually on energy. Government programme experience, advice from energy auditors and independent analysis suggests that many businesses and households can save 10–30 per cent on their energy costs without reducing productivity or comfort levels. In many cases these savings have very short paybacks under current energy prices. Achieving these reductions could deliver $5–$15 billion in potential savings from energy, but would require significant investment in new equipment and changes to existing practices. Experience and analysis indicate that these investments would have a positive net present value over the life of the investment, and that many have paybacks in as little as six months.

Recent analysis, done as part of the National Framework for Energy Efficiency (NFEE), identified substantial areas where commercial energy efficiency opportunities are not being taken up. It found that significant energy efficiency opportunities with paybacks of four years or less exist across the commercial, residential and industrial sectors. The analysis estimated that if half of these gains were commercially attractive implementing them would increase GDP by around $975 million a year once fully implemented. The analysis did not encompass the transport sector. (NFEE 2004)

Work done by the Council of Australian Governments (COAG) Energy Market Review identified substantial economic gains from facilitating demand side responses in the national energy market (COAG Energy Market Review Panel 2002). The review estimated that improving market arrangements in this area would increase GDP by about $630 million a year. Some of the economic gains identified by the COAG review flow from improved energy efficiency, while the remainder comes from other sources, like commercial decisions to stop (or lower) production or switch off appliances in response to prices.

BUSINESS BENEFITS FROM IMPROVED ENERGY EFFICIENCY

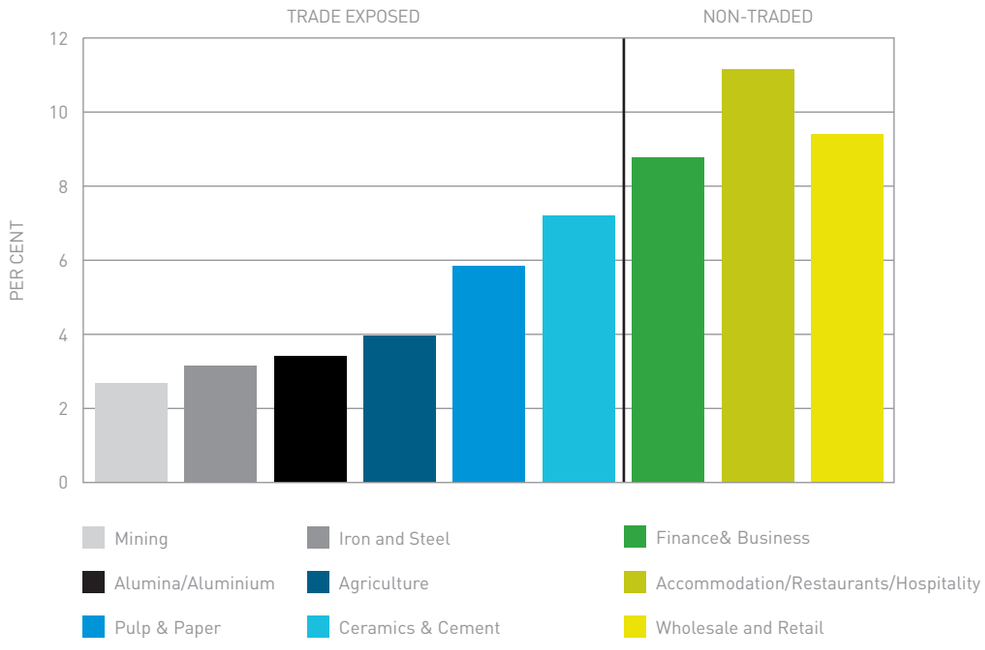
Government experience, such as the Greenhouse Challenge, Energy Efficiency Best Practice, and a range of state government programmes, show a large potential for cost-effective energy savings:

- Hardy Wine Company and Southcorp invested $254 000 and achieved total annual projected savings of $136 000 per year. A wine company also avoided additional capital investment of $1.25 million.
- Amcor's Botany Bay fibre packaging plant invested $250 000 on energy reduction, saving $400 000 per year in natural gas, with a further $300 000 saving planned by September 2004.

- Australia Post saved $500 000 as part of a Greener Motoring programme conducted through the Australian Fleet Managers Association. Savings came through minimal cost actions such as choosing more fuel efficient vehicles, moving from single trailers to double trailers, and using larger but fewer trucks to carry out the deliveries to major distribution centres.
- A major bank in NSW is achieving annual savings of $400 000 at an internal rate of return of 46 per cent through its energy management plan, following participation in a NSW government scheme.
- Normandy Mining managed to cost-effectively reduce the electricity use per tonne of processed ore by 25 per cent at its Pajingo mine expansion.

Studies indicate that energy efficiency opportunities exist across the commercial, residential and industrial sectors. The NFEE analysis estimated that implementing all energy efficiency with a payback of four years or less would reduce residential energy use by 13 per cent, commercial energy use by 10.4 per cent and industrial energy use by 6.2 per cent. As noted earlier, not all of these would be the best commercial opportunities available to firms.

Figure 2: Energy efficiency potential



Source: Data prepared for the Ministerial Council on Energy's National Framework on Energy Efficiency project, see NFEE (2004)

High energy use in the industrial sector means that even small increases in energy efficiency can have a significant effect on the demand for energy (and resulting greenhouse emissions) overall. The industrial sector accounts for almost two-thirds of final stationary energy use and about half of potential energy savings based on NFEE potentials. Within the industrial sector, energy efficiency opportunities are greatest in the non-traded industries.

Table 1: Where is the potential for energy efficiency in Australia?

Sector	Energy efficiency potential (%)	Energy end use 2000–01 (PJ)	Percentage of energy use (%)	Energy efficiency potential (PJ)	Percentage of energy efficiency potential
Manufacturing and mining	6.2	1250.0	67	78	51
Commercial	10.4	224.0	12	23	15
Residential	13.0	399.5	21	52	34
Total		**1873.5**	**100**	**153**	**100**

Source: Based on ABARE (2003) and unpublished ABS data, NFEE (2004)

Less information exists about the potential for commercial energy efficiency improvements in the transport sector. Transport accounts for 41 per cent of final energy use in Australia, and energy efficiency gains could have significant impacts. Experience with the Australian Fleet Managers Association has shown significant potential to improve energy use in fleets through a range of measures, such as choosing vehicles better suited for their purpose, improved maintenance, and better route planning.

GOVERNMENT ACTION

The potential economic and environmental gains from increasing the uptake of commercial energy efficiency opportunities warrant a high-priority response from government. Past efforts to improve energy efficiency have had successes, but have been focused largely on the residential and commercial sectors. More limited results have occurred in the industrial energy sector.

The Australian Government is determined to improve the uptake of commercial energy efficiency opportunities by Australian businesses and households, and will focus policy on:

- improving market signals through reform of Australia's energy markets
- setting minimum energy performance requirements for widely used appliances and residential and commercial buildings
- providing information for consumers and businesses about the energy performance of appliances and buildings
- encouraging (and in some cases requiring) firms to identify and report on energy use and energy efficiency opportunities within their business
- working within the Australian Government, and with state and territory governments to improve the delivery of existing programmes.

To provide further information on energy efficiency and possible policy responses the government will also establish a Productivity Commission inquiry to examine the potential economic and environmental benefits from improving energy efficiency. The inquiry will report in the second half of 2005, and examine the full range of options to improve energy efficiency. The government will consult with the states and territories on its terms of reference.

IMPROVING MARKET SIGNALS

The Ministerial Council on Energy's reform programme for the Australian energy market includes a strong focus on improving market signals and arrangements for demand side management. These reforms will provide greater incentives for the uptake of energy efficiency.

The government will complement these reforms through its Solar Cities trials. These trials (which are being developed as part of Australia's long-term strategy for climate change) will bring together support for energy efficiency technologies in the context of revised market arrangements. The trials will provide a substantial living demonstration of the benefits of energy efficiency.

SETTING MINIMUM STANDARDS AND IMPROVING INFORMATION

The successful Minimum Energy Performance Standards (MEPS) programme will be further expanded in concert with state and territory governments. MEPS will be applied to a greater range of appliances (gas appliances and some commercial equipment), and more stringent standards will be applied to appliances already included. MEPS have proved an effective way of encouraging the introduction of more efficient appliances. Cost–benefit analysis of the current MEPS programme suggests that it will deliver cumulative net economic benefits of $4 billion in the period 2003 to 2018, and save about 7 million tonnes of greenhouse emissions per year by 2010. (AGO 2003)

Energy performance standards for buildings will continue to be extended to multi-dwelling residences and commercial buildings. Existing building standards are expected to save energy costs of $500 million and reduce greenhouse gases by 1.5 million tonnes over the life of the buildings constructed in the first 10 years of the standards being introduced. (ABCB 2002 and 2004). These benefits flow largely from reduced heating and cooling costs from the use of more energy efficient design and materials.

The government has in place a National Average Fuel Consumption agreement with the car industry. This agreement involves a target of reducing the average fuel consumption of new cars sold in Australia from 8.43 litres per 100 kilometres to 6.8 litres per 100 kilometres by 2010.

The Australian Government will introduce further energy intensity targets for 'tenant light and power' with regard to its own agencies. Additional requirements will be set for appliances and vehicles. Agencies previously had a target of reducing the intensity of tenant light and power by 25 per cent between 1997 and 2003. This target was achieved and delivered $30 million in annual energy savings by 2003.

Information measures will also be improved. To complement the existing performance ratings for commercial and residential buildings, the government will work with the states and territories to require landlords and building owners to disclose energy performance information in leases and sales agreements. The Green Vehicles Guide will be released to provide consumers with objective, up-to-date information on the fuel consumption and other environmental performance of all vehicles with a gross vehicle mass of up to 3.5 tonnes. This complements the recently upgraded fuel consumption label that appears on new vehicles.

IDENTIFYING ENERGY EFFICIENCY OPPORTUNITIES

Existing government measures focus largely on the commercial and residential sectors, and have relatively little impact on the industrial sector. Some states have measures that target industrial users, with some requiring low-level audits and the uptake of energy efficiency opportunities in some cases. The Greenhouse Challenge programme also requires low-level energy audits by members.

The very largest energy users in Australia (those using more than 0.5 petajoules a year—around 250 firms) account for almost two-thirds of all energy used by business. These are mainly industrial firms but include a number in the commercial sector. Improving the uptake of commercial energy efficiency opportunities by these firms has the potential to significantly enhance economic welfare while reducing greenhouse emissions.

To facilitate the uptake of these opportunities the government will require large energy users to undertake a rigorous assessment of energy efficiency opportunities every five years starting in 2006. These assessments will be undertaken consistent with an improved Australian standard and will be designed to identify energy efficiency investments with a payback of four years or less. Firms will be required to report publicly on the outcomes of the assessment, and will be free to make decisions on investments identified via their normal business processes. The government will act to ensure the assessments are rigorous and comprehensive, and to disseminate the lessons learned to the wider business community. Public reporting will be designed to provide the markets with useful information while protecting firms' reasonable commercial interests. Details of the regime will be developed in consultation with relevant stakeholders.

STREAMLINING REQUIREMENTS

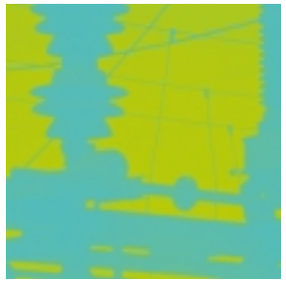
Firms are currently required to provide information on energy use and emissions to a range of state and territory and Australian government agencies. The Australian Government will pursue opportunities to streamline the provision of existing information, using the Greenhouse Challenge programme as a single entry point. To achieve this, the government will develop a plan for integrating existing requirements by the end of 2004.

The government will raise the plan with state and territory governments through the National Framework for Energy Efficiency, with a view to taking a cooperative approach to streamlining existing reporting requirements.

Use of the Greenhouse Challenge programme as a single entry point for energy efficiency and greenhouse partnerships reflects the key role played by energy efficiency in future climate change responses. The programme provides a solid foundation for building partnerships with industry. Streamlining requirements through Greenhouse Challenge will also complement decisions to make participation in the programme mandatory for a range of larger energy users.

LOOKING FORWARD

Energy efficiency has the potential to play a key role in enhancing Australia's economic welfare and lowering our long-term emissions from the use of energy. The government looks forward to improved energy efficiency performance in businesses and households as a result of the policy framework set out in the White Paper, actions arising from the Productivity Commission review in 2005. The government will continue an active and helpful dialogue with the states and territories through the National Framework for Energy Efficiency process.



7 ENERGY SECURITY

Key Points

- Australia has a high level of energy security:
  - a natural endowment of crude oil, vast coal and gas reserves, potential for renewable energy, and access to imported fuels
  - extensive infrastructure to deliver power, gas and transport fuels to business and households
  - good access to world markets.
- Australia's major long-term security challenge will be to attract timely large-scale investment in sustainable supply systems to meet the growing demand for energy.
- The main short-term threat to national energy security involves short-term disruptions to energy production and distribution. The Minister for Industry, Tourism and Resources is fast-tracking work with state and territory governments through the Ministerial Council on Energy to develop a cross-jurisdictional mechanism for handling major gas disruptions, complementing that which already exists to handle oil supply disruptions.
- The level of security in transport fuels is not currently under threat. The government will protect national fuel security by continuing to engage with the international community to promote open oil markets and maintain a high level of global capability in addressing global or regional oil supply disruptions.
- In response to recent world events, the government has assessed the risks to all nationally significant critical infrastructure, including major stationary and transport energy assets, and strengthen Australia's responses to those risks.
- The government places high importance on maintaining Australia's level of energy security. The government will review the energy security outlook at least every two years, including scrutiny of global developments, and take action when needed to protect Australia's energy security.

INTRODUCTION

The importance of energy to Australia's society and economy means that governments must place a high priority on ensuring that consumers have reliable, competitively priced supplies of energy.

Recent events, both here and overseas, have reinforced this. Blackouts in Western Australia, the Moomba gas plant fire, and power losses in Italy and North America are timely reminders of the major impact interruptions can have. A more uncertain world environment, exemplified by recent threats to the electricity network, also indicates the possibility of terrorist strikes on Australia's energy infrastructure assets.

Reliable, competitively priced energy supplies underpin economic development and standards of living in the community. Energy resources must be available, either through domestic production or imports. Infrastructure to transform these resources into usable products, along with electricity and gas distribution networks, must be adequate to the task. Investment in all these facets of the energy supply chain must be timely as demand expands. All these factors must work smoothly if energy supplies are to meet demand reliably.

Energy security involves balancing of supply reliability versus cost—increasing energy reliability can be expensive. This expense flows onto prices and lowers the competitiveness of the Australian economy. Therefore, energy security policies must pursue enhanced reliability while maintaining competitive energy prices.

AUSTRALIA'S ENERGY SECURITY POSITION

Any consideration of Australia's energy security position must pay close heed to overseas experiences and the lessons of the past. One major international lesson is that policies which seek to pre-empt or override market forces rarely work in the longer term. Examples of this in the world are plentiful. New Zealand's experience in subsidising conversion of gas to liquid fuels has led to the uneconomic depletion of a valuable national resource. California's recent energy shortages are generally ascribed to a policy environment that effectively prevented retail businesses from covering escalating costs, while demand was increasing.

Another lesson is that major energy problems in Australia have generally come from accidents at key supply infrastructure rather than underlying problems in accessing resources or intentional disruptions. The Longford gas explosion in 1998 and the fires at the Moomba gas plant on New Year's Day 2004 are two key examples of unintentional disruptions. But our experience to date must, of course, be set in a changing world context where the potential for terrorist acts has increased.

Any examination of energy security also needs to consider a number of factors which affect the vulnerability of our stationary and transport energy sectors to disruptions.

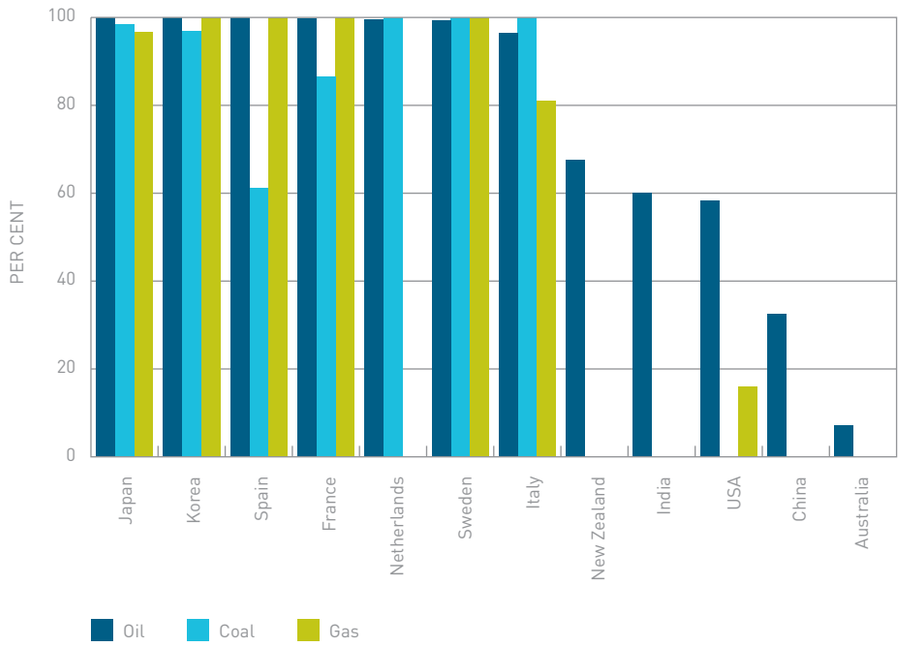
One key factor in the stationary sector is that electricity can not be stored cost-effectively. Ensuring the stability of the electricity supply system (on which society is becoming increasingly dependent) therefore requires supply to be closely matched to demand at any point of time. Major interruptions in supply can, as a result, have an immediate and substantial impact. Peak electricity demand, which generally results from the use of airconditioning on hot days, can also cause problems as demand exceeds supply. Pricing mechanisms in the stationary energy sector are not yet strong enough to play a serious role in helping to balance supply and demand in these circumstances.

Unlike stationary energy, transport energy (basically petroleum products) can be stored and interruptions in supply are less likely to have an immediate impact. Australia's refining industry is capable of meeting most of the nation's domestic petroleum product needs, notwithstanding the closure of the Port Stanvac refinery. Pricing mechanisms in the transport energy sector are more developed than in the stationary sector, and play a key role in balancing demand and supply.

Another important factor is Australia's geography and population size. Servicing such a dispersed population requires substantial, often expensive infrastructure. This is a particular issue for Australia's electricity and gas systems, which remain relatively weakly connected across state boundaries. This partly reflects the economics and history of supply, but also reflects market rules which have worked against investment in transmission infrastructure. Market reforms undertaken to date have improved the situation, with additional transmission links being built, improving the interconnectedness of energy supply systems and, with it, their reliability and security. In the absence of these links, and in particular the south-east Australian gas (SEA Gas) pipeline, the impact of the Moomba fires on South Australia would have been much greater.

Access to energy resources is another major determinant of energy security. There is no doubt that Australia's abundant energy resources are a key security advantage for Australia. Concerns about a lack of domestic resources have driven many other nations to employ expensive security policies, which have added to prices and lowered their international competitiveness. Australia, on the other hand, can meet all of its stationary energy needs using domestic resources and has sufficient reserves for many decades into the future.

Figure 1: Net import dependency, 2000



Source: International Energy Agency, Energy policies of countries 2002 review

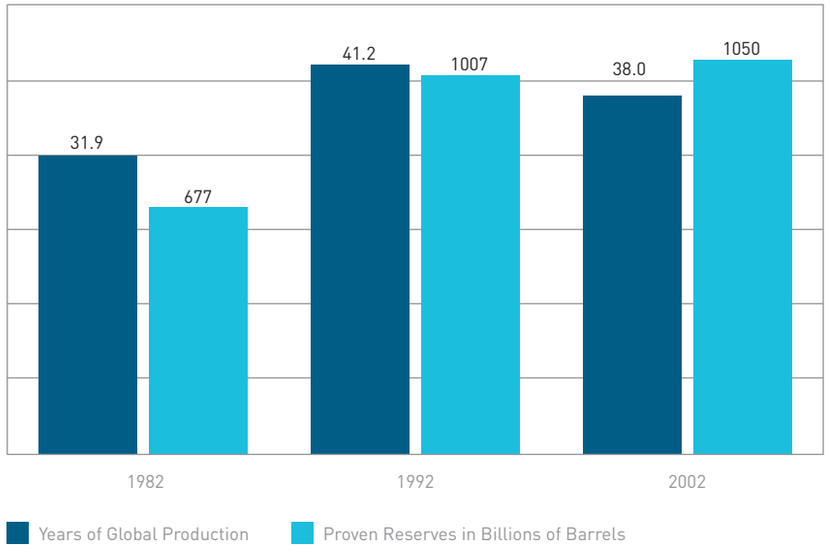
Australia's domestic reserves of oil are less abundant, but are nonetheless significant and play a useful role in meeting demand for transport fuels. In value terms, Australia produces enough oil to meet around 80 to 85 per cent of its domestic fuel needs. This is in stark contrast with most other developed economies which rely very heavily (and often exclusively) on imported oil. However, the nature (light, sweet crude which attracts a premium on export markets) and location of Australian oil (more than two-thirds of Australian oil is produced in the north and north-west with ready access to export markets) means that much of Australia's output is exported, and that local production contributes between 35 and 40 per cent of the input to Australian refineries. Converting these exports to domestic production would involve moving the resource from a higher-value market to a lower one. Hence some 60 per cent or more of refinery feedstock is imported, relying on Australia's good access to world oil markets.

TRANSPORT FUELS

Oil-based fuels—petrol and diesel—dominate the road transport fuels market in Australia and most countries.

The dominance of petrol and diesel reflects their properties as fuels, and their relatively low cost of production, refining, transport and use compared with other potential fuels. World crude oil prices, while fluctuating over time, have declined in real terms over the last two decades, notwithstanding recent sharp price increases. Part of the reason is that additional discoveries have increased world stocks of oil. World oil reserves increased from about 680 billion barrels in 1982 to about 1050 billion barrels in 2002. Despite increasing demand for oil, there are sufficient reserves to supply world demand for around 40 years.

Figure 2: Global oil reserves



Source: BP, Statistical Review of World Energy 2003

Demand growth for oil is being tempered by continuing substitution of oil in stationary applications by, for example, electricity generated from coal, liquefied natural gas or nuclear sources, and the emergence of more fuel-efficient vehicle technologies (including hybrid technologies). The impact of these advances is, however, being reduced by a move in many OECD countries to larger vehicles with more features (such as airconditioning).

Ensuring reliable access to petroleum supplies is a key concern for many countries. Large importers of oil and refined fuels, such as the United States and Japan, have responded to these concerns by stockpiling, investing in oil-producing regions and encouraging alternatives to petrol and diesel.

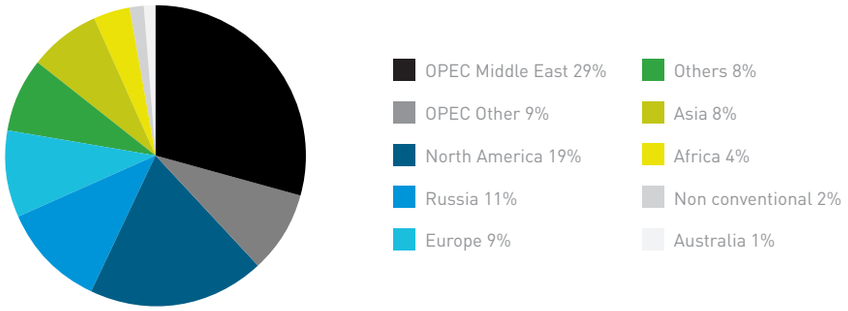
The dominance of the Middle East as the primary oil-producing region, the ability of these countries to act as a cartel through OPEC, and the political instability of some countries in the region have been major factors behind concerns about transport fuel security. In the longer term, concerns also exist about the longevity of oil supplies.

WORLD OIL SUPPLIES

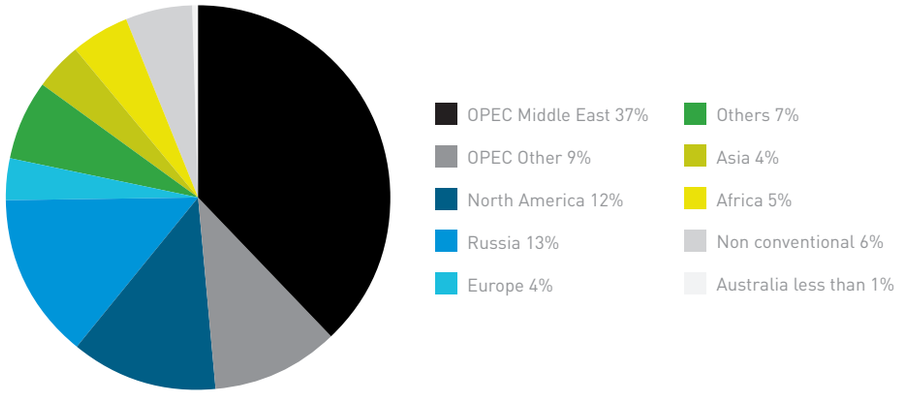
The role played by the Middle East in world oil production is set to increase. The proportion of total world oil production from OPEC is expected to rise from 29 per cent in 2000 to 37 per cent in 2020, with the key Middle East members accounting for almost all of the change. Recent discoveries and reserve reassessments in, for example, the Russian Federation, while adding to total available supplies of oil, will not change this trend.

Figure 3: Global oil production

2000: Total production 75 million barrels per day



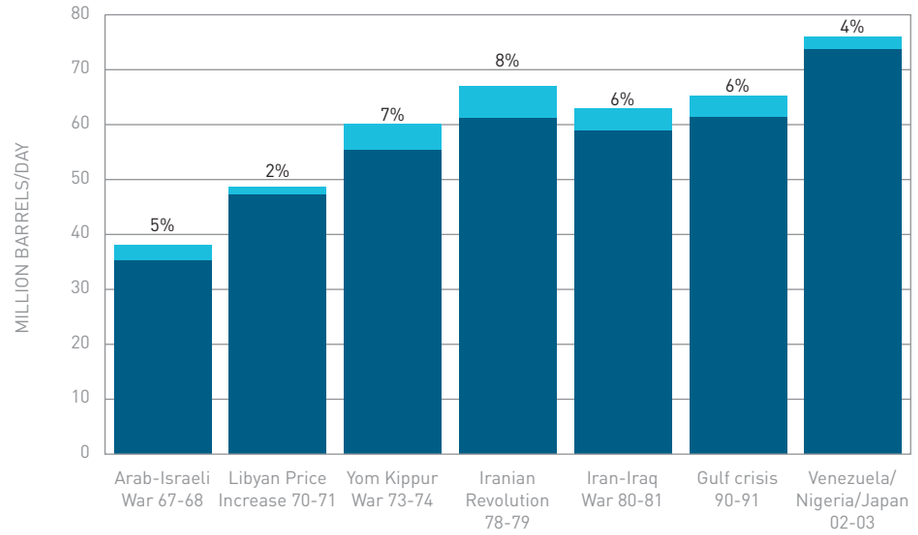
2020: Total production 104 million barrels per day



Source: International Energy Agency, World energy outlook 2002

The growing role of the Middle East needs to be placed into context. Past disruptions have had a relatively small impact on world flows of oil, and have not had a major impact on the reliability of oil supplies to Australia. Australia, like other countries, has had to face increases in oil prices, often with significant economic impacts, but access to oil has not been a major problem. As a nation, Australia consumes only about one per cent of world oil supplies.

Figure 4: World oil supply disruptions



Source: International Energy Agency, 2002

The potential for disruptions in world oil supplies from any major producing region poses challenges for the world as a whole. These challenges require a global response. Multilateral efforts to ensure that world markets remain open and that effective response mechanisms are in place to mitigate the impact of short-term supply disruptions remain Australia's best path to provide for the continuity of oil supplies.

AUSTRALIA'S INVOLVEMENT IN IEA AND APEC ENERGY SECURITY MECHANISMS

International Energy Agency—Oil security system

As a member of the International Energy Agency (IEA), Australia is required to participate in the IEA's oil security system.

In March 1979, Australia acceded to the IEA Agreement on an International Energy Programme, which sets out the basis of the Emergency Oil Sharing System for participating countries. Under this agreement, Australia is required to maintain emergency reserves equivalent of at least 90 days of net oil imports, provide a programme of demand restraint measures, and participate in oil allocation measures amongst IEA members in the event of a severe oil supply disruption.

Collectively, IEA member countries are currently holding 4 billion barrels of public and industry oil stocks, representing at least 112 days of net imports. Since the IEA's inception in 1973, the largest oil disruption occurred at the time of the 1978–79 Iranian revolution. This resulted in a supply shortfall of approximately 5.6 million barrels of oil per day (mb/d) for a period of six months. A June 2002 IEA study shows that IEA stockdraw potential is sufficient in magnitude and sustainability to cope with the largest cited historical supply disruption (IEA 2002 c).

During the 1991 Gulf crisis, the IEA activated a contingency plan to make 2.5 mb/d available to the market. Australia's contribution was 46 000 barrels per day, met through surge production and demand restraint.

APEC energy security initiative

The APEC Energy Working Group Energy Security Initiative (ESI) includes measures to respond to short-term disruptions in energy supplies and longer-term responses to securing adequate, reliable and affordable supplies of energy in the APEC region. Measures being implemented under the ESI include:

- Joint oil data initiative to improve the data available to oil market participants.
- Sea lane security: A sea lane disruption simulation exercise was conducted by the Asia Pacific Energy Research Centre in April 2002, which identified necessary actions for preparing APEC economies to address disruptions.
- Real time emergency information sharing system, to be used by member economies in the event of an energy supply emergency affecting the region.

Longer-term responses are being developed through the ESI including energy infrastructure and financing, energy efficiency, and cross-border interconnection of electricity and gas.

The ESI was endorsed at the Fifth Meeting of APEC Energy Ministers (Mexico City, 23 July 2002) and APEC Economic Leaders endorsed a range of measures to advance implementation of the ESI at their meeting in Bangkok in October 2003.

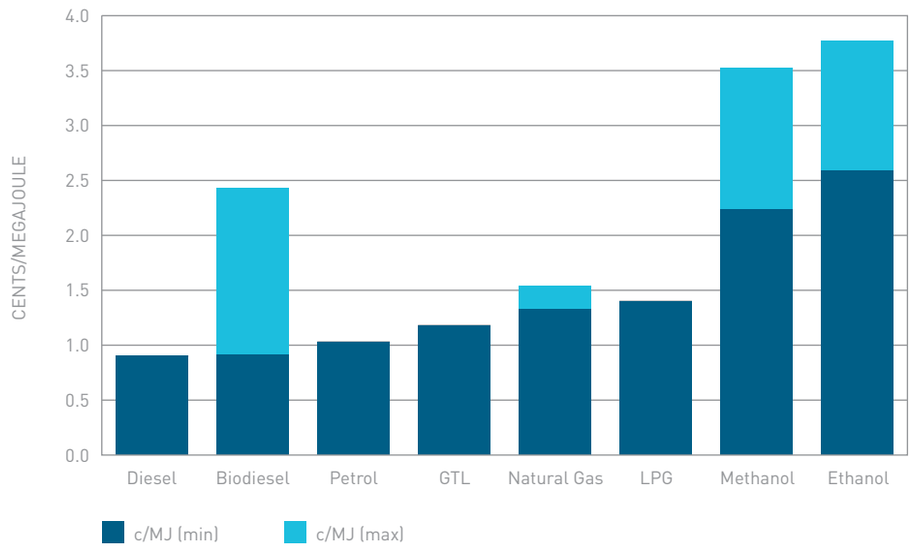
The regional security issues addressed by ESI are significant for Australia, since much of its oil imports originate in, or pass through, the Asia Pacific. The regional response to energy security challenges contained in the ESI helps to underpin the long-term economic and social development of many of Australia's near neighbours and trading partners.

ALTERNATIVE SOURCES OF TRANSPORT FUELS

Australia is fortunate in having access to potentially large sources of alternative fuels and new sources of conventional fuels. Technology exists that could be used to convert our substantial natural gas and coal reserves to conventional transport fuels such as diesel. Australia has enormous shale resources that can be processed to produced conventional fuels such as petrol, and diesel. Australia also has reserves of naturally occurring liquefied petroleum gas (LPG) (a co-product of natural gas and oil production) and the ability to use natural gas in the form of compressed natural gas (CNG) and liquefied petroleum gas (LPG) as transport fuels. Significant resources for the production of biofuels (ethanol and biodiesel) also exist, as does the potential to produce hydrogen from a variety of sources.

The potential energy security value of these resources differs. Fuels like LPG, CNG, LNG and hydrogen require engine modifications or specific engine technologies, and are only of value for consumers with those technologies. This lessens their value as a solution to short-term disruptions. Supplying a substantial proportion of fuel requirements from biofuels would be difficult and require the transfer of land use from other productive purposes. For example, converting the total national oilseed crop to biodiesel would only produce 6 per cent of Australia's current diesel needs. The lower energy content of these fuels is another factor, with all fuels (other than some biodiesel production) having higher production costs per unit of energy than either conventional petrol or diesel. Oil shale resources are very large, but technical and cost issues are proving barriers to widespread exploitation of this resource. All of these alternative fuels have received significant government support for an extended period through excise exemption, which dates back more than 25 years.

Figure 5: Indicative energy costs of transport fuels (net of tax)



Source: Australian Government estimates

Note: Prices of petroleum fuels vary with international oil prices and exchange rates. Minimum and maximum prices for biofuels and natural gas–sourced fuels reflect large variations in feedstock prices and/or throughput volumes. Based on an oil price of US$35 per barrel and an exchange rate of A$1 = US70cents.

The existence of these resources provides comfort that Australia is well positioned to respond to any long-term changes in the supply conditions for oil. Investors are actively pursuing commercial development of many of the above fuels, with an eye to domestic (and in some cases export) markets. This again provides comfort that if and when these resources become commercially attractive (e.g. in the event of a sustained rise in oil prices), they will be developed.

The above factors mean that there is currently no case for the government to accelerate the uptake of these fuels on energy security grounds. To do so would involve additional costs for consumers, with few energy security benefits. It would also ignore a key energy security lesson from the past: namely, governments should work with markets, and not pre-empt them, in choosing technologies and solutions for the future.

RESPONDING TO DISRUPTIONS

The ability to store both oil and refined transport fuels lessens the immediate impact of any disruption. In recent years, total national stocks of crude oil and product have been about 50 days of supply. These numbers hide a wide variation amongst different regions, different products (petrol and diesel tend to be lower, of the order of 15 to 18 days) and seasonal changes. Over time there has also been a tendency to reduce stocks in line with good commercial practice. Occasionally, this can lead to shortages of a particular product in a given location when interruptions in the supply chain occur, such as the shortage of aviation fuel in Sydney in September–October 2003.

Crude oil and refined product imports play an important role, with crude oil imports accounting for more than 60 per cent of refinery input, with Asian suppliers prominent. Additional crude oil imports can generally be sourced in 24 to 25 days from Singapore, with Middle East supplies taking somewhat longer (with refined products available in a similar time).

These overall factors mask regional differences. Australia's geography and population size involve long supply chains, with limited alternative options in some areas. The time required to source alternative supplies puts a high premium on local refinery reliability. Emergency response plans need, therefore, to ensure that supply options are identified and that effective approaches are in place to ensure that the needs of these areas are considered appropriately in the event of a major disruption.

Australia has never experienced a significant disruption to national transport fuel supplies. Disruptions have occurred in specific locations, and have generally been resolved quickly. However, the potential for disruptions does exist. Under the Liquid Fuel Emergency Act, the Australian Government has the authority to prepare against, and manage available resources during, a national liquid fuel emergency. A national group, comprising state and industry representatives, known as the National Oil Supplies Emergency Committee, overseen by the Ministerial Council on Energy, provides the practical focus for any implementation of the Act. In cooperation with the states and industry, the Liquid Fuel Emergency Response Plan has been developed. This plan was tested during a simulation exercise conducted in June 2003. The Act also provides the basis for meeting our International Energy Agency obligations, which might be triggered in the event of a major international disruption of oil supplies. The government has called for tenders to undertake a review of the Act to see whether the existing arrangements constitute best practice, and how they might be improved.

The government has also established the Critical Infrastructure Advisory Council, comprising Australian and state and territory government representatives, as well as critical infrastructure owners and operators. This council is designed to assess system vulnerabilities, methods of threat mitigation and consequence management for infrastructure such as information technology, water, energy and banking systems. The Energy Group, established under this umbrella (and including industry and government representatives), is working to ensure that there are adequate levels of protective security on critical energy infrastructure, and rapid, tested recovery procedures. During March 2004, a multijurisdictional counter-terrorism exercise was held to validate the national counter-terrorism arrangements, including those relating to offshore petroleum facilities. The 2004 Budget included some $4 million to protect Australia's energy infrastructure from disruption. Contingency plans for energy emergencies will be developed, and exercises held in each capital city to test the effectiveness of emergency plans.

Developing government-mandated minimum stockholdings (or government-owned stockpiles of fuel) is a possible way of enhancing Australia's ability to cope with supply disruptions. Such approaches are adopted in some other nations, notably the USA and Japan. The cost of building and maintaining a stockpile is, however, substantial. For example, a stockpile of 20 million barrels of oil (26 days normal demand) would cost around $1 billion to acquire. Had a stockpile been available, it is doubtful that it would have been used in the past 30 years. The government considers that a stockpile is not currently needed but that the issue may need to be re-examined if circumstances change significantly in the future.

ELECTRICITY AND GAS

Security of stationary energy supplies (mainly electricity and gas) has generally received less popular attention than transport fuels. The critical role played by electricity and gas in our society demands the provision of reliable supplies of stationary power. This has been reinforced recently both in Australia and overseas, with disruptions to gas supplies from Moomba and the major electricity blackouts in North America and Europe.

Access and resources

Australia's abundant stationary energy resources, and good quality infrastructure to exploit them, provide a high degree of security. Unlike many nations, Australia not only has the ability to meet its stationary energy needs completely from indigenous sources, but it also has a variety of resources on which to draw. Australia's reserves are large enough to supply our needs for many decades into the future. This is a major national advantage.

Infrastructure

The security of supplies of stationary energy must also take into account the infrastructure needed to transform and transport energy to users. Infrastructure for stationary energy has three dimensions: first, the infrastructure for generating electricity and producing gas; second, the network for transmitting electricity or gas from its source to major consuming regions (this determines the level of competition between energy sources); and third, the infrastructure for delivering electricity and gas to customers.

Australia's electricity generation capacity largely comprises a series of major coal-fired plants supplying around 78 per cent of our needs (ABARE 2003). The economic life of these plants is long (40 to 50 years), and replacement costs are high, of the order of $1.1 billion for a 750 MW generating plant. Projections suggest that further investments in generation capacity will need to be committed in advance of 2010, unless demand growth slows markedly. Proponents of major generation assets require a high level of confidence about the economics of a project before investing. This is equally true of gas production facilities, with offshore platform costs being high.

The need to match closely demand and supply for electricity and, to a slightly lesser extent, gas places great importance on the delivery infrastructure and supporting market arrangements. Australia is fortunate in having generally good quality infrastructure and well-developed market arrangements.

Despite the quality of Australia's domestic energy infrastructure, disruptions due to accidents have occurred recently at both Longford and Moomba. Industrial disputes have the potential to disrupt supplies of electricity and gas but, in keeping with the general industrial relations climate, such interruptions have declined markedly in recent years. Vulnerability to accidents and sabotage at key choke points in the system remains a risk and could cause significant problems. Geoscience Australia will contribute to the government's capacity to analyse the consequences of critical infrastructure failure, helping to plan for a range of events from natural disasters to disruptions caused by terrorism.

As noted earlier in Chapter 3, our electricity and gas systems remain weakly connected across state boundaries. Market reforms are going some way to address this, with the development of new electricity connections (e.g. Basslink connecting Victoria and Tasmania) and gas pipelines (e.g. the SEA Gas pipeline connecting South Australia to the Otway Basin). Such interconnections provide a considerable increase in the security and reliability of energy supplies, as well as competitive benefits. Australia's retail delivery network for both gas and electricity is also well-developed and generally reliable.

Ability to cope with disruptions

The national electricity market (NEM) has a sophisticated system for balancing supply and demand in those regions it covers (the NEM excludes Western Australia and the Northern Territory; Tasmania will join when Basslink is operational). The arrangements for the NEM are robust, with dual control centres in Sydney and Brisbane capable of managing the NEM independently.

Problems experienced in recent times stemmed from accidents at Longford and Moomba (gas) and short-term electricity interruptions caused by demand spikes during summer conditions in Victoria and South Australia. These problems have generally been handled well, although the cost of Longford to the Victorian economy was large.

Unlike for oil supplies, no formal cross-jurisdictional mechanism currently exists for coping with major unplanned disruptions to gas and electricity markets. For electricity, the NEM framework provides a robust response mechanism. However, for gas the same assessment cannot be made with confidence, as weaker interconnections and inflexible contracts may limit market responses. At their meeting in April 2004, members of the Ministerial Council on Energy agreed to establish the new Energy Security Working Group, comprising senior officials who will have ongoing responsibility for managing the National Liquid Fuel Emergency Response Plan. The new group has also been tasked with developing emergency response protocols for the gas sector, including its interaction with electricity supplies, based on the Moomba experience. This project, due to be completed in December 2004, will also involve substantial industry and user consultation.

Ability to cope in the longer term

The major longer-term issue confronting the stationary energy sector is ensuring that investment in new supply, transmission and distribution capacity meets rising demand in a timely and efficient manner. Given the urgency of these investments, providing an appropriate policy and regulatory environment for them is a high priority for the Australian Government. This is discussed further in Chapter 3, Energy markets—Delivering Australia's electricity and gas needs.

LONG-TERM SECURITY OF GAS SUPPLIES

Australia's gas reserves are sufficient for more than 100 years at current production levels, or more than 200 years of current domestic consumption. Furthermore, prospects for finding and proving up more gas are good, subject to finding markets. However, the location of Australia's major gas reserves—to the north and north-west—compared with major demand locations—to the south-east—is sometimes raised as an issue (see Figure 6 and 3 in Chapter 2—Developing Australia's Energy Resources).

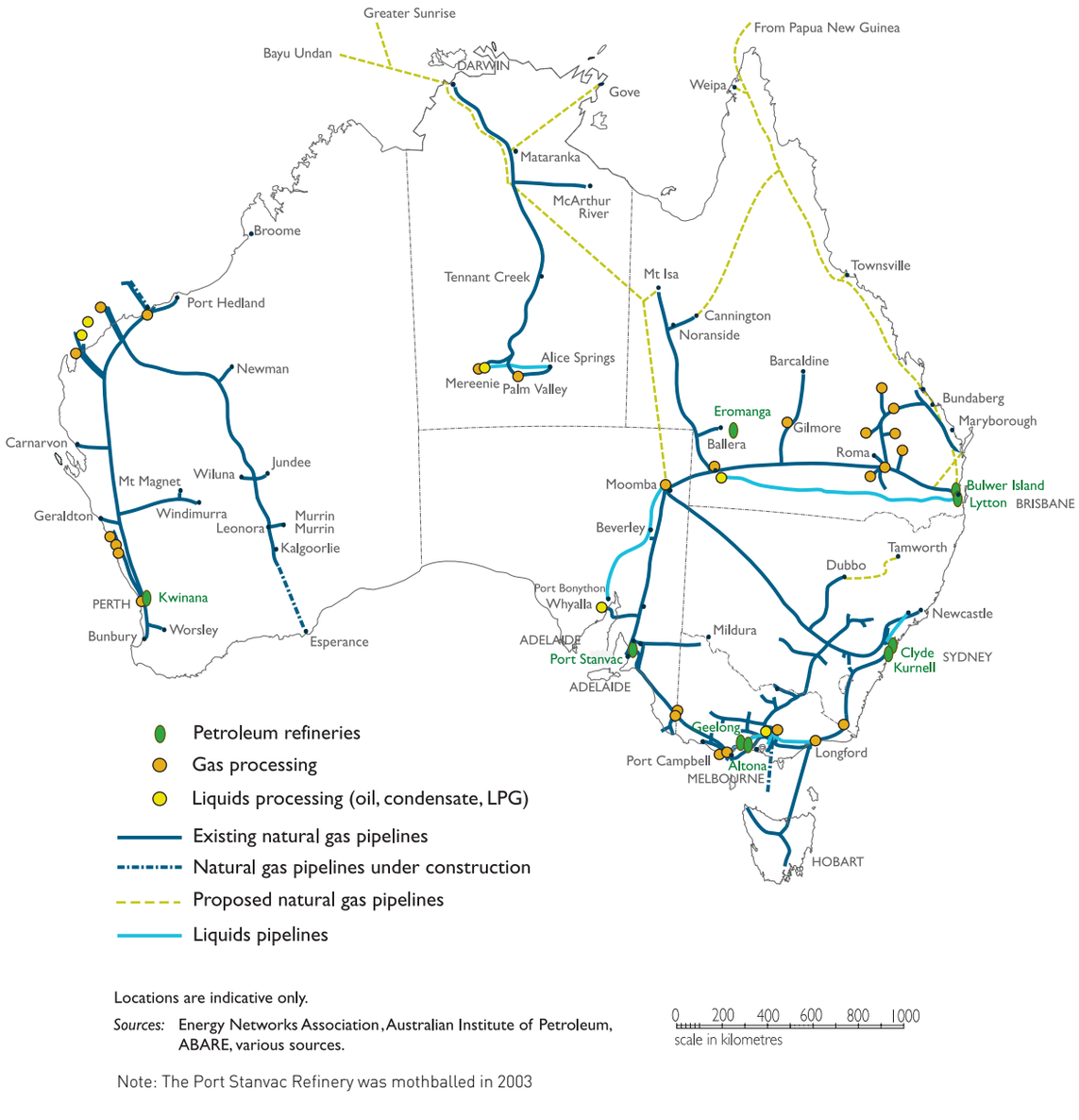
Predictions are made that supplies of gas to major urban markets will run short in the next decade, as production in the Cooper Basin and Bass Strait declines. This has resulted in calls for financial support towards the building of major pipelines from either the Northern Territory (to access gas from Sunrise and other Timor Sea fields), Papua New Guinea or north-west Australia (to access gas from either Carnarvon or Browse Basins). While reserves of gas in existing fields close to south-east markets are declining, this does not represent an energy security concern. Exploration is occurring in the south-east and is resulting in new discoveries and development, such as in the Otway Basin. The development of coal seam methane is also increasing supplies of gas in the region.

In addition, holders of the large remotely located gas reserves are actively seeking markets to monetise these reserves. These efforts include actively investigating pipeline projects for bringing supplies of gas from north and north-west sources, as well as seeking LNG export sales in Asian markets. The number and activity of these competing proposals provide a degree of confidence that these supplies will become available once economic, noting that this will in all likelihood occur at higher price levels than those currently enjoyed in some south-eastern markets.

Given the size and placement of gas reserves relative to current and future gas demand, gas supply is not likely to become an issue for the short to medium term. Pre-empting market outcomes in these circumstances is unlikely to add significantly to energy security, but could inflict significant costs by precluding less costly options (such as further development of the Gippsland and Otway basins or coal seam methane).

Rather, the government's focus will be on continued market reform, so that competitive energy markets can determine the timing, size and placement of gas supply infrastructure, and so that impediments to new pipeline investment with adequate capacity are removed.

Figure 6: Map of Australia's natural gas pipelines



Note: The Port Stanvac Refinery was mothballed in 2003

LOOKING FORWARD

Further major action on transport fuel security is not, at this stage, needed in Australia. The operation of a strong market for transport fuels, mitigation strategies by industry (like the decision to establish minimum targets for jet fuel stocks and implement new jet fuel supply assurance procedures) and emergency response arrangements (both here and internationally) provide confidence in Australia's ability to provide reliable supplies and competitively priced fuels into the future. Security will be further enhanced by critical infrastructure work and the outcomes of the Review of the Liquid Fuel Emergency Act. The government will, however, closely monitor fuel supplies.

In the stationary sector, the greatest long-term risk is the inability to attract adequate investment in a timely fashion to meet growing gas and electricity demand. The Australian Government will continue to pursue improvements to the energy market and pursue a longer-term climate change strategy. These approaches are discussed further in Chapters 3 and 8 respectively.

While Australia's energy security position is currently sound, the government will not be complacent. Rather, the government will continue to monitor local and international events, and ensure that response mechanisms are in place and ready to go if needed. The government will also undertake a biennial review of the nation energy security outlook. This review will consider the adequacy of existing policy and our international commitments and obligations.

8

CLIMATE CHANGE AND ENERGY

Key Points

- Australia is committed to a prosperous economy with a lower greenhouse signature. The Australian Government has a comprehensive strategy for meeting greenhouse objectives in the short and long term, while underpinning the value of existing resources, and maintaining competitiveness.
- Australia will continue to actively pursue an effective global response that encompasses the world's major emitters and avoids distortions that might lead to the international transfer of economic activity and emissions with no environmental benefits. The Kyoto Protocol does not meet these criteria.
- Australia remains firmly committed to achieving its Kyoto target of keeping emissions to 108 per cent of 1990 levels by 2008–12. With current policy measures, we are on track to meet this target and will continue to monitor progress.
- The shape of future international action on climate change is unclear, but the potential costs of future adjustments and long life of energy assets makes it prudent to prepare for the future. The Australian Government's strategy includes a suite of approaches focussed primarily on reducing the cost of meeting a future greenhouse constraint:
  - reducing the cost of a broad range of low-emission energy technologies for the future, including establishment of a $500 million fund to support industry-led demonstration projects of these technologies, and a further $100 million to support development of smaller-scale renewable technologies
  - $75 million Solar Cities trials to provide working demonstrations of how technology and efficient markets can combine for a sustainable energy future
  - facilitating commercially attractive emissions reductions, including through mandatory energy efficiency opportunity assessments, an enhanced Greenhouse Challenge programme and better energy markets
  - supporting uptake of low-emission energy by continuing the Mandatory Renewable Energy Target, and removing barriers to the use of renewable energy.

INTRODUCTION

Addressing human-induced climate change is a major issue for the 21st century. Emissions of greenhouse gases have the potential to trigger higher global temperatures, leading to a range of deleterious effects, including more heatwaves, flooding, drought, storms, bushfires and disease. In the absence of further action, world emissions of greenhouse gases are projected to increase substantially.

The balance of scientific opinion is that global emissions of greenhouse gases need to be reduced if changes in climate are to be avoided. Analysis by the Intergovernmental Panel on Climate Change indicates that reductions of some 60 per cent of annual global emissions are required by 2100 to avoid more than doubling pre-industrial levels of greenhouse gases in the atmosphere. Such changes require a long-term perspective that recognises long infrastructure lives and time taken to introduce new technologies. Even with substantial emission reductions, some climate change is likely to occur. Investment in adaptation will be required in addition to abatement.

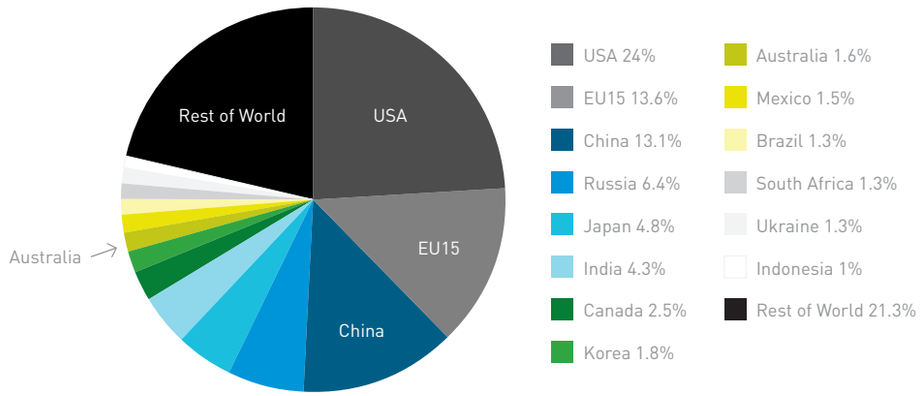
SOURCES OF EMISSIONS

Emissions of greenhouse gases come from a variety of sources and locations. Comprehensive and accurate data do not exist on greenhouse emissions for many nations, making it difficult to develop a precise picture of the world scene. However, some general observations are possible and provide a useful background to policy making in Australia.

The first is that the production and use of energy is a large source of emissions. The World Resources Institute estimates that about 60 per cent of global emissions in 2000 came from carbon dioxide emissions from energy use (WRI 2003). Effective international action to address climate change will require that energy sector emissions be reduced. But a sole focus on energy would not be appropriate, especially as there are many cost-effective abatement opportunities in other sectors.

The second is that a small number of nations (or a union of nations, in the case of the European Union) account for a large proportion of global emissions. According to WRI, six nations (United States, European Union, China, Russia, Japan and India) account for nearly half of global emissions and nearly two-thirds of carbon dioxide emissions from energy. The United States alone accounts for more than one-fifth of global energy-related emissions.

Figure 1: Shares of global energy based CO_2 emissions, 2001



Source: Data from International Energy Agency

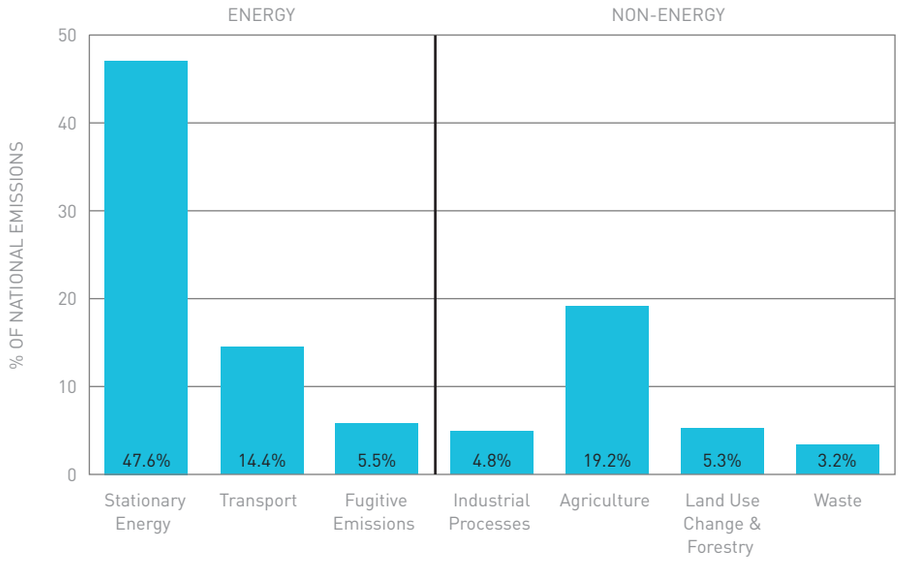
Expected economic growth in less developed countries, such as China and India, will result in emissions from these nations increasing substantially over the next 20 to 30 years. Total emissions from less developed countries, which have no quantitative targets under the Kyoto Protocol, are expected to soon overtake those from industrialised countries. It is clear that, to be effective, any global response must encompass the world's major emitters.

GREENHOUSE EMISSIONS AND THE AUSTRALIAN ENERGY SECTOR

Australia contributes 1.6 per cent of world greenhouse emissions from energy. Changes in our emissions profile are not, of themselves, going to make a significant difference to global emissions. Australia's low-emission energy exports and technology help other countries to lower their emissions profile. But it is only in concert with other nations that Australian action on climate change can be globally effective.

Australia's emissions come from a variety of sources. The production and use of energy provides the single largest source, accounting for 68 per cent of total emissions in 2002 (with electricity production accounting for 33 per cent, and transport energy 14 per cent of the national total). Agriculture was the next largest contributor at 19 per cent, with the other 13 per cent of emissions from land use change and forestry, industrial processes and waste. Emissions from non-energy sectors have generally been falling or flat, with total emissions from these sectors falling by 78 Mt from 1990 to 2002. This is especially due to significant declines in land use emissions. By contrast, energy sector emissions rose by 85 Mt over the same period.

Figure 2: Sources of Australian emissions, 2002



Source: Australian Greenhouse Office, National Greenhouse Gas Inventory 2002

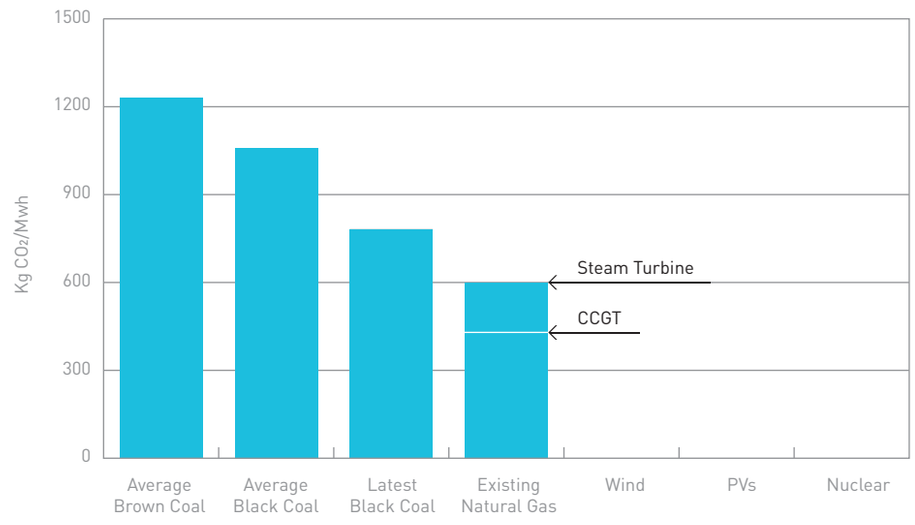
Any significant reduction in Australia's long-term greenhouse signature must involve changing the way we produce and use energy. Under current measures, the share of emissions from energy production and use is projected to rise to 72 per cent by 2020, and is likely to continue increasing. This reflects both growth in demand for energy, and expected continuing declines in the significance of land use emissions.

Australia's energy sector emissions reflect our fuel mix, economic structure, and lifestyles: electricity generation is dominated by coal; energy-intensive resource processing industries are a major part of our economy; and electricity use is growing rapidly. Personal transport is largely based on private, medium-to-large vehicles, and Australian building design has traditionally paid little attention to energy performance.

Electricity generation

Australia has some of the lowest-priced energy in the industrial world, due largely to the wide availability of inexpensive coal. Thirty three per cent of Australia's greenhouse emissions come from electricity generation, with 92 per cent of this from coal. While advances in technology are significantly lowering the emissions intensity of new coal-based electricity plants, they remain the most emission-intensive form of electricity in widespread use.

Figure 3: Indicative emissions intensity of electricity generation



Source: Australian Government estimate 2004

Australia has large resources of energy, such as gas, hydro, wind uranium and solar, which have lower emissions intensities than coal. Combined-cycle gas-fired electricity, for example, has emissions typically one-half of new black coal plants, while energy technologies such as wind, solar and nuclear can deliver electricity with virtually zero emissions.

Impediments exist to the use of some of these sources. Gas reserves, while substantial, are mostly far from major domestic markets and cannot be delivered in large volumes without significant additions to pipeline or shipping capacity. Australia's large-scale hydro potential is largely exploited, with little scope for expansion. Wind and solar are intermittent, which will limit their penetration in the longer term unless affordable electricity storage becomes available. Use of uranium reserves raises cost, safety and waste disposal issues in power generation. While industrialised countries on average generate 24 per cent of electricity from nuclear power (IEA 2002 b), Australia is not contemplating the domestic use of nuclear power. Other potential low-emission electricity sources, like electricity produced using 'hot dry rocks' or fossil fuel generation with capture and storage of emissions, are yet to be commercially demonstrated.

Many of these impediments can be overcome with sufficient expenditure. However, wide-scale uptake of low-emission base load electricity generation at current costs would lead to substantial increases in electricity prices, which would reduce Australia's competitiveness. This situation will remain for some time, even though the cost of many energy sources is falling.

Australia's inexpensive electricity has seen substantial investment in resource processing and other energy-intensive industries. The production of alumina and aluminium, paper, cement, chemicals, metals and minerals processing require large amounts of energy. These sectors are highly sensitive to price changes, with small changes in energy prices making a significant impact on industry profitability and therefore investment attractiveness. International competition for investment in these sectors is strong, with many countries competing actively for new investment opportunities. If increased Australian electricity prices resulted in future investment happening in other countries, the net global greenhouse impact could be negative if these countries had higher emission intensities than Australia. This would lead to economic losses for Australia, as well as greater global environmental damage. It has been estimated that industries such as paper, cement and aluminium directly employ more than 35 000 people, mainly in regional Australia.

Table 1: Effect of electricity price increases on profitability

Industry	Energy costs as a proportion of production costs %	Earning before interest and taxes (EBIT) margin %	Effect of 10 per cent increase in energy prices on EBIT margin %
Aluminium smelting	20	14	-14
Paper manufacturing	20	9	-22
Chlor/Alkali production	20	15	-13
Brick manufacturing	18	10	-18
Steel production	11	14	-8
Nickel production	10	17	-6
Copper/Uranium production	10	8	-13
Gold production	8	7	-11
Cement production	7	8	-9

Source: Business Council of Australian (2000) as found in COAG Energy Market Review.
Note: Final column adjusted to reflect change in EBIT from an increase in prices rather than decrease.

Energy exports

Australia is a major exporter of energy products, particularly coal, gas and uranium. In a global response to greenhouse, coal exports could be at risk unless low-emission ways of generating coal-fired electricity are developed. Production of LNG for sale is an energy-intensive process, and results in significant greenhouse emissions. While LNG project developers are implementing measures to reduce these emissions, a single large

LNG development could increase Australia's energy emissions by around 1 per cent of energy sector emissions. However, to the extent that exported Australian gas replaces more greenhouse intensive energy in the importing country, global emissions may decrease as a result of Australian gas production. Similarly, exports of uranium reduce global emissions to the extent the nuclear power produced replaces higher emission sources. Under the Kyoto Protocol arrangements, the emissions from producing these fuels would be credited to Australia, but the emissions savings from their consumption would accrue to the country that uses them.

Transport

Transport accounts for 14 per cent of Australia's greenhouse emissions (AGO 2004). In the short to medium term, improving vehicle fuel economy and transport system efficiency offer the greatest greenhouse emission reduction potential in this sector. The Australian Government is improving fuel standards to facilitate the introduction of more fuel efficient vehicle technologies and has negotiated an agreement with the automotive industry to significantly improve the fuel efficiency of the car fleet. The government's AusLink package will support improved transport system efficiency.

In the long term, hydrogen could provide an environmentally friendly fuel alternative, although significant developments in safety, cost and technologies for producing and transporting hydrogen will be required. Transport issues are complex and closely related to lifestyle choices. All countries have found it difficult to effectively manage greenhouse emissions from the transport sector.

Industrial and commercial energy use

While coal and oil supply the vast bulk of national energy demands, natural gas plays an important role in some states and territories in electricity generation, and as industrial fuel. Some forecasters, including the Australian Bureau of Agricultural and Resource Economics, anticipate growth in gas market share through greater use in electricity generation and penetration into the iron and steel sector. Much of this is related to increasing production of iron through direct reduction in Western Australia, and additions to alumina refining. These developments will tend to lower the greenhouse intensity of the energy sector, although total emissions would rise.

AUSTRALIA'S APPROACH TO CLIMATE CHANGE

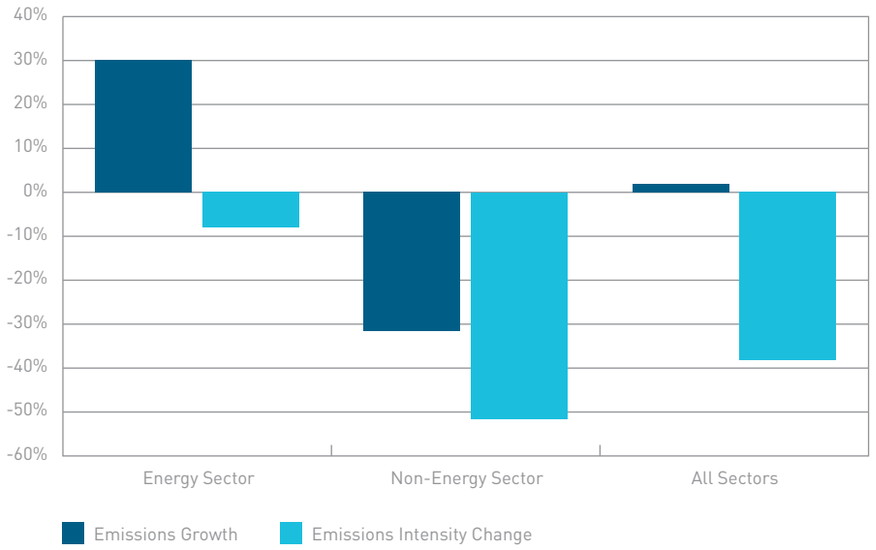
Australia recognises the necessity of lowering global greenhouse emissions and that achieving this will require substantive action over the long term. Internationally, Australia is committed to pursuing effective global action, and will continue to actively engage with other nations to this outcome. To be effective, a global response must encompass the world's largest emitters and address the issue of economic activity and emissions potentially moving from one nation to another with no overall global greenhouse benefit.

MEETING THE KYOTO TARGET

Domestically, Australia is committed to maintaining a strong and internationally competitive economy while lowering its greenhouse signature. Australia is committed to meeting its Kyoto target of keeping greenhouse emissions to 108 per cent of 1990 levels by 2008–12. Unlike many countries that have ratified the Kyoto Protocol, Australia is on track to meet its target, and will continue to monitor progress. This has been achieved through a comprehensive approach to greenhouse abatement.

Considerable progress has been made in decoupling emissions from economic growth. Australian national greenhouse gas emissions in 2002 were just 1.3 per cent above 1990 levels, despite an increase in GDP of 47 per cent over that period. Australia's emissions per unit of GDP have declined substantially, by 31 per cent from 1990 to 2002. However, in the energy sector, emissions grew 30 per cent from 1990 to 2002. Energy sector emissions per unit of GDP have fallen by 8 per cent over that period (AGO 2004).

Figure 4: Emissions and emissions intensity changes (1990–2002)



Source: Australian Greenhouse Office National Greenhouse Gas Inventory 2002

Abatement measures already taken through partnerships with government, industry and the broader Australian community are expected to deliver annual emissions abatement of some 67 million tonnes by 2008–12—the equivalent of taking all of Australia's cars, trucks and buses off the road. Without these measures, greenhouse gas emissions were projected to be 123 per cent of 1990 levels by 2008–12.

The Australian Government has allocated more than $1 billion for greenhouse gas abatement. Major elements include[1]:

- Minimum Energy Performance Standards for appliances, equipment and buildings will deliver 8.3 Mt of abatement in 2010 as well as more than $4 billion in net economic benefits over the 2003–2018 period.
- The Greenhouse Challenge programme will deliver 13.2 Mt of abatement in 2010 and has helped more than 700 Australian companies identify and act on emissions abatement opportunities while saving money and increasing product quality.
- The Mandatory Renewable Energy Target will deliver 6.5 Mt of abatement in 2010 and drive over $2 billion in investment in new renewable energy generation.
- The Greenhouse Gas Abatement programme has allocated over $100 million to companies to achieve large scale abatement in the 2008–12 period, and will deliver 10.3 mt of abatement.
- The Ozone Protection and Synthetic Greenhouse Gas Management Act 1989, as amended in 2003, sets the international standard for managing synthetic greenhouse gases.

The Australian Government's 2004–05 Budget included a strengthened approach to greenhouse policy. The government is building on the success of its current climate change programme with a significant strengthening to focus and integrate its measures in five strategic areas:

- positioning Australia to further reduce its greenhouse signature as the economy continues to grow strongly
- engaging internationally to contribute to developing an effective global response to climate change
- addressing the risks, capturing the opportunities and preparing Australia for the impacts of climate change
- building our understanding of the science of climate change and our capacity to measure greenhouse emission trends accurately
- advancing whole of government policy making in this area.

Australia's vigorous and successful pursuit of the Kyoto 108 per cent target underlines the willingness to play a positive role in addressing global emissions. Many of the measures designed to achieve savings in the 2008–12 period will have benefits for much longer. But the Australian Government will not ratify the Kyoto Protocol, as it does not provide the effective global framework required for meeting long-term objectives.

1. Abatement figures based on 2003 projections. Enhancements to Australia's greenhouse programme were made in the 2004–05 budget and new forecasts are being developed.

A longer-term approach

Addressing climate change requires action over a long period, well beyond the normal commercial and political horizons. The Australian Government recognises the need to reduce Australia's greenhouse signature in the long term, and the need for a nationally consistent approach to achieve this aim.

Any long-term greenhouse strategy must have regard to the prevailing international situation. Australia is pursuing international action on climate change at the multilateral, plurilateral and bilateral levels. It is not yet clear, however, what the future shape of international action on climate change will be. No internationally agreed global regime to contain emissions exists for the period beyond 2012, or is currently in prospect. In the absence of such a response, and given Australia is on track to meet its Kyoto 108 per cent target, it is premature to impose significant economy-wide costs in order to meet a specific long-term target, such as through an emissions-trading regime. Such costs would harm Australia's competitiveness at this time, without making a significant difference to global emissions.

Whatever the future shape of international action on climate change, it is prudent for Australia to take some action now in anticipation of a future international response. Waiting for an effective global response before taking any further action is not an option. The size of greenhouse reductions that may be needed over the long term demands that a strategy be introduced to prepare the economy to respond to future emissions constraints. The long life of energy infrastructure also means that even long-term objectives can be affected by near-term decisions. Electricity generating plant built in 2004, for example, will still likely be operating in 2050 and beyond, and so contribute to Australia's emissions profile over that period. With planning timeframes added in, an investment made today can have emissions impacts 50–70 years in the future. Buildings and transport infrastructure have similarly long lives. In addition, development of new technologies to the point of commercial readiness can take 10 years or longer.

The Australian Government considers that a managed approach to future risks is prudent, and provides the basis for an effective long-term greenhouse strategy. Meeting any long-term domestic greenhouse constraints will require changes to the way we produce and use energy. The strategy recognises that government will not solve the greenhouse problem by itself, and is designed to engage industry in a way that allows it to invest in the future. The strategy builds on Australia's approach to achieving the Kyoto target of 108 per cent. Importantly, it avoids the premature imposition of significant economy-wide costs and includes measures designed to underpin the long-term value of Australia's resource base.

The strategy is based on strong, practical action across a broad suite of approaches to increase the range of options and lower the cost of meeting future greenhouse objectives. These can be categorised into four key areas:

- Developing a wider range of lower-cost low-emission technologies. Future greenhouse objectives could require significant penetration of low-emission technologies that at current prices would be very expensive. Ensuring a wider and lower-priced range of technologies increases future flexibility. In developing these technologies, special attention needs to be paid to the ability to preserve the value of our energy exports.
- Integrating low-emissions supply technologies, energy efficiency and flexible markets, through major demonstrations of how future energy arrangements can deliver economic prosperity with a lower greenhouse signature.
- Facilitating the identification and uptake of commercially attractive abatement options. This reduces the magnitude of any future emissions constraint and enhances the economic capacity to respond to future challenges. It also includes measures that increase the abilities of businesses and households to understand and manage their greenhouse emissions, and market arrangements that increase flexibility such as greater demand side management.
- Continuing support for facilitating the transition to low-emissions energy sources. This includes direct support for the uptake of new technologies and practices as well as implementing appropriate regulatory and market frameworks that do not discriminate against new technologies.

Developing low-emission technology

Technology improvements will be a key to delivering large-scale reductions in emissions in a way that protects and promotes Australia's long-term economic prosperity. Technology developments are reducing the cost of low-emission technologies, but the cost of delivering low-emission electricity, in particular, remains high. The challenge for Australia is to reduce the costs of these technologies, so that there is a range of more competitively priced low-emission technologies available.

As is recognised in Chapter 10, Energy Innovation—Building a bridge to the future, Australia's strategy recognises that much technology development will occur overseas. The pursuit of low-emission technologies is in the context of a broad strategic view of Australia's interests. Australia must be ready to work collaboratively in international arrangements where appropriate, and must be ready to adapt and adopt technologies to our circumstances.

Table 2: Indicative costs and emissions for selected electricity generation technologies

(Low-emission technologies in bold)

Technology	$/MWh cost in 2010[1]	kg CO2/ MWh
Natural gas combined cycle (NGCC)	35–45	430
NGCC with geosequestration	**n/a**	**80–150**
Integrated gasification combined cycle (IGCC)—black coal	n/a	720–750
IGCC—black coal—with geosequestration	**n/a**	**150–200**
Supercritical/(Ultra-supercritical (SC/USC)—black coal	30–35	780–820
SC/USC—black coal—with geosequestration	**n/a**	**150–200**
Integrated dewatered gasification combined cycle (IDGCC)—brown coal	n/a	780–820
IDGCC—brown coal—with geosequestration	**n/a**	**150–200**
Supercritical (SC)—brown coal	36–40	1000–1100
SC—brown coal with geosequestration[3]	**n/a**	**250–300**
Wind	**55–80[2]**	**0**
Bagasse[3]	**30–100**	**0–?[4]**
Small hydro[3]	**50–70**	**0**
Delivered electricity[5]		**950–1000**
Residential (including off-peak)	**50–210**	
Maximum pool price[6]	**10 000**	
Solar hot water	**80–100[7]**	**0**
Photovoltaic	**250–400**	**0**

Sources: Australian Government estimates based on IEA (b 2001), IPCC (2002), US DOE (2004). ABARE (2003 b), BCSE et al (2002) and unpublished data

1. Listed as n/a when stage of development indicates technology will not be available by 2010.
2. Costs based on meeting less than 20 per cent of electricity supply.
3. Limited resources are available.
4. Depends on fuel source.
5. Solar hot water and photovoltaics (PV) are distributed energy sources, and so compete with delivered prices for electricity rather than against other sources of generation. Solar hot water does not produce electricity so the comparison is conceptual. PV output available at peak demand times in some states and territories, when wholesale prices are at their highest.
6. This represents the maximum wholesale price. While retail prices would not go this high, it represents the value of reduced demand at the highest peak times, so is an upper value bound.
7. As solar hot water does not create electricity, prices are notional.

TYPES OF LOW EMISSION TECHNOLOGIES

There are a wide range of technologies being developed that could significantly reduce the greenhouse signature of energy production and use, including a variety of electricity-generating technologies. Some of these are relatively mature technologies, such as some wind and bagasse; others are commercially available but developing rapidly, such as solar; while others are at or still to reach demonstration stage, such as hot dry rocks and carbon capture.

A set of technologies involves capturing carbon dioxide as part of electricity generation or other industrial processes and storing it deep underground in either depleted petroleum reservoirs or saline aquifers (known as geosequestration). These technologies could substantially lower emissions from coal and gas electricity generation. Some of the basic technology for achieving this exists. Technologies for separating carbon dioxide from natural gas, for example, are proven and the petroleum industry routinely reinjects gas into active oil fields to increase production. However, significant challenges remain in separating carbon during electricity generation processes, combining carbon dioxide capture and storage in an electricity generation context, ensuring long-term storage and meeting competitive requirements for reliability and cost. Demonstrating the commercial applicability of these technologies is likely to be expensive and take at least 10 years. A great deal of commercial effort is now going into exploring the potential of these technologies, such as through the COAL 21 project in Australia, the US-led Carbon Sequestration Leadership Forum, and the $US1 billion Futuregen Project in the United States. International collaboration on geosequestration is also an important element of the US–Australia Climate Action Plan.

Further reductions in the costs of wind, solar and other non-conventional resources can be expected. Analysis by the International Energy Agency (IEA) shows that prices of energy technologies have been falling while the global rate of uptake is increasing.

Solar energy is generally produced 'on location' and replaces delivered energy rather than wholesale energy. This means that solar energy competes not with wholesale electricity prices, but with retail prices which are 2–5 times higher. Projected reductions in the price of solar technologies, if realised, could result in these technologies being competitive against delivered energy prices. Solar energy output is also highly correlated with peak demand, when electricity is most expensive to produce, but current market arrangements do not recognise this value of solar energy.

Other potential technologies are also being explored. A pilot project for producing energy from hot dry rocks has been established in the Cooper Basin, assisted by a $0.8 million Renewable Energy Commercialisation grant in the conceptual stage and a $5 million R&D Start grant.

Technologies are also in prospect that reduce demand for energy. New energy efficient industrial processes are being developed for a range of industries. Methods are being introduced to better manage traffic flows and reduce fuel consumption.

Reducing the cost of low emissions and energy efficiency technologies lowers the cost of achieving any long-term emissions constraints, that may exist as part of an effective global response. At this stage it is impossible to say which technologies will prove most cost-effective; this must be tested in a commercial context. Coal and gas-based technologies also would help underpin the future export value of Australian resources in an emissions-constrained world. While industry does have some risk management incentives to pursue these technologies, uncertainties regarding future global greenhouse regimes mean that investment is not occurring at a desirable pace or magnitude.

To address this, the government will establish the $500 million Low-Emission Technology Development Fund to support industry-led projects to demonstrate low-emission technologies. These technologies must have the potential to lower Australia's emissions by at least 2 per cent in the long term at a realistic uptake rate, and be commercially available by 2020 to 2030. The fund is designed to facilitate private sector investment of at least $1 billion, and provides a path by which industry can invest in a low-emissions future.

The fund is aimed at supporting technologies at the commercial demonstration stage, when required investments are large and risks remain high. Particular consideration will be given to technologies that could underpin Australia's resource base and/or promote leading-edge technology capacity in Australia, ensuring maximum benefits for both the economy and the environment. The fund will also support appropriate adaptation of technologies developed overseas to Australian circumstances, including international collaboration. Support will not be given for technologies that are likely to be developed overseas and imported into Australia with little need for local adaptation, and will not be used to support business-as-usual investments.

To support earlier-stage and smaller-scale renewable energy technology development projects, the Australian Government will provide $100 million over seven years for competitive grants to promote the strategic development of renewable technologies, systems and processes that have strong commercial potential. This programme, which will include $50 million from the existing Commercial Ready programme, will continue support for innovative Australian companies and technologies, ensuring that there is a continuing supply of ideas for low-emission technologies for the long term.

Establishment of these funds will complement Australia's substantial existing energy research and development effort, which includes university funding, ARC grants, R&D Tax Concessions, R&D Start, CRCs and the CSIRO. In 2001–02, the Australian Government spent $180 million on energy-related R&D. The National Research Priority Goals announced by the Prime Minister include 'reducing and capturing emissions in transport and energy generation'. One of CSIRO's six Flagship programmes is Energy Transformed, whose overall goal is the cost-effective reduction of greenhouse gas emissions from the energy sector. The May release of Backing Australia's Ability—Building our future through science and innovation, saw an enhanced commitment of $5.3 billion over seven years from 2004–05 for greater science and innovation efforts. The Australian government commitment to sustainable energy R&D will ensure that innovative technologies continue to be developed from original concepts to commercial use.

Solar Cities—A vision for the future

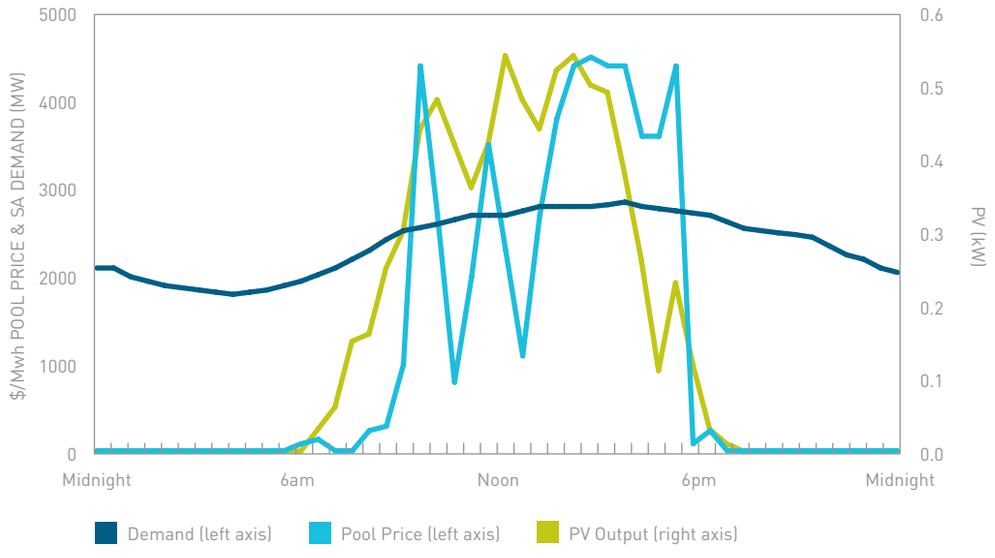
Australia's long-term greenhouse response in the energy sector foresees integrated use of low-emission supply technologies, significantly enhanced energy efficiency and markets delivering appropriate price signals. An operational model of such a future facilitates this transition. The Australian Government will provide $75 million to support the establishment of solar cities trials in urban areas to provide these working models.

These trials will demonstrate a potential new energy scenario, with distributed solar power, energy efficiency and reformed energy markets all playing a major role in meeting energy needs. The trials will involve the uptake of solar energy and energy efficiency technologies by a substantial proportion of residents and businesses. To facilitate this, the government will subsidise specific technologies and facilitate their incorporation into existing and new residential and commercial buildings.

Solar power is a zero emissions energy source, in which Australia has developed leading-edge technologies. Solar power can be utilised either as heat (e.g. solar hot water systems) or the conversion of solar power to electricity (through PV systems). Solar technologies are used widely in Australia, and receive significant government support.

As a form of distributed generation, solar energy can reduce the need for transmission and distribution infrastructure—something not fully attributed in the market. Peak output from solar energy often coincides with peaks in demand for electricity, generally hot days with high airconditioner usage. Wholesale prices for electricity in these periods can be 100 times the average.

Figure 5: Peak load and PV output—Adelaide, 8 February 2001



Source: M.E. Watt, M. Oliphant, H. Outhred, R.Collins, Using PV to meet Peak Summer Electricity Loads, ANZSES Conference, Melbourne 2003

Current electricity market arrangements do not appropriately reward these benefits of solar technologies, nor do they provide appropriate price signals for energy efficiency. Therefore, the trials will also involve the trialing of pricing and other market arrangements that better reflect the value of using solar energy and other 'demand side' action. These arrangements would include time-of-day pricing, interval metering and cost-reflective buy-back arrangements for electricity. Pricing mechanisms would be developed in consultation with industry and governments, and would be designed to ensure that consumers were not made worse off during the trial period. Getting these signals right in the market can have important economic and environmental benefits. For example, delaying the need for new generation infrastructure reduces costs as well as allowing more time for development of low-emission generation options.

Trial results will be monitored for at least five years, and compared with appropriate baseline data. Impacts on transmission and distribution costs would be carefully assessed, providing the first empirical evidence of the magnitude of these savings.

To be successful, the trials will need to involve the cooperation of industry, state, territory and local governments. The Australian Government will work with these parties to develop detailed proposals to host the trials, with a view to selecting the best locations. A total of $75 million will be allocated to the project, to support the uptake of technologies and to establish monitoring arrangements.

Facilitating commercially attractive abatement options

Chapter 6, Energy efficiency, identified improving Australia's energy efficiency performance as a key goal for government. In the 2004–05 Budget, the Australian Government announced enhancements to an already effective set of measures designed to improve Australia's energy efficiency performance, while also reducing economic costs. These include minimum energy performance standards for appliances and equipment, energy standards and rating tools for buildings, efficiency labelling for motor vehicles, and improved energy efficiency of government operations. These measures will be supplemented by the introduction of mandatory energy efficiency opportunity assessments for large energy users. This will provide information for investors to better judge performance. A Productivity Commission inquiry into energy efficiency potential and possible policy options will also be established.

The government will also introduce a tiered system of Greenhouse Challenge membership that allows committed companies to provide private sector leadership on greenhouse abatement. Recipients of more than $3 million in annual fuel excise credits, and proponents of large energy resource development projects will also be required to demonstrate effective management of their greenhouse gas emissions through membership of the Greenhouse Challenge programme.

The Australian Government will also continue to pursue effective energy market reform, including ensuring national energy markets are more responsive to distributed generation (where generation is located close to demand) and demand side management (where energy users receive incentives for reducing use, especially at peak times). Making markets more efficient helps the economy and ensures greater flexibility in responding to any future emissions constraints. The Australian Government will work with the states and territories through the Ministerial Council on Energy to identify by December 2005, and act on, specific rule changes required in the National Electricity Market to maximise the benefits of distributed generation.

These measures are designed to assist firms better manage energy emissions in a way that improves economic performance and greenhouse outcomes. They also provide assistance in developing tools to identify and act on cost-effective opportunities, and markets that facilitate such responses. The measures also have the potential to delay demand for new generation investment in base load power generation, providing time for the costs of lower-emission options to be reduced.

Transition to lower-emission technology

The Australian Government will continue to support the uptake of low-emission energy from renewable sources through the Mandatory Renewable Energy Target (MRET), but will not extend or increase the target. The policy will continue to provide a growing target for renewable energy until 2010 and ongoing support for the sector until 2020.

A recent review of MRET, conducted by an independent panel, recommended that the target be extended from 9500 Gwh by 2010 to 20 000 Gwh by 2020 and beyond (MRET Review Panel 2003). This target, while providing a subsidised growth path for renewable energy, would impose significant economic costs through higher electricity prices. The Review estimated that implementing its recommendations would double the current projected cumulative economic cost of MRET to over $5 billion by 2020 in net present value terms. The Australian Government does not believe these costs can be justified.

MRET will continue to play a significant role in supporting the renewable sector, and will underpin $2 billion in renewable energy investment in the period to 2010. The scheme has played a important role in demonstrating the potential for renewable technologies, in reducing renewable energy project costs and facilitating the development of 'soft' infrastructure such as regulatory and market structures. In increasing renewable capacity, the scheme has largely supported currently available technologies, and provides little direct support for the development of new low-emission technologies.

The Australian Government considers a better path is to build on the successful outcomes of MRET to more directly promote the development and demonstration of a broader range of low-emission technologies, and more aggressively address the impediments to the uptake of renewable energy. The $500 million Low-Emission Technology Development Fund and the $100 million in funding to promote the strategic development of renewable energy technologies are key parts of the strategy, as are the Solar Cities Trials.

Some important low-emission technologies, especially wind and solar, are intermittent—they generate only when wind or light is available. This intermittency presents a key impediment to the wide uptake of these technologies as it means they are unable to always deliver electricity on demand. To help address this issue, the government will establish an $18 million fund to support development of advanced electricity storage technologies. Low-cost ability to store generated energy and use it when required will increase the attractiveness of intermittent technologies. This programme will provide funding on a competitive basis to leverage investments in demonstrating technologies

Increasing the penetration of wind energy, in particular, also poses challenges in managing the balance between supply and demand in the National Electricity Market. To facilitate the increasing use of wind, the Australian Government will provide $14 million over five years to assist the development and installation of software and systems to allow accurate wind forecasting. Overseas experience shows that forecasting systems can be effective with access to commercially sensitive data from a large number of widely dispersed sites. The government will establish partnerships with state and territory governments, and seek private sector funding on a matching basis. Implementation of forecasting systems will not only assist market management, but also will improve strategic planning for wind farms and increase the value of wind energy to electricity retailers. This could allow wind to locate in a wider range of sites away from sensitive landscapes.

These measures will build on the substantial existing support for renewable energy, including through the Photovoltaic Rebate programme, the Remote Renewable Power Generation programme, the Renewable Energy Equity Fund, the Renewable Energy Commercialisation programme and the Renewable Energy Industry Development programme. The Australian Government has allocated more than $300 million for renewable energy support over the last six years.

LOOKING FORWARD

The strategy outlined above delivers on current commitments and prepares the economy to respond to any long-term emissions constraints that may be required as part of an effective global response to climate change. The strategy positions Australia well to maintain prosperity while reducing our long-term emissions signature. The strategy addresses the periods to and beyond Australia's Kyoto 108 per cent target. It positions Australia to maintain its position as a leading international supplier of energy resources and technologies, by moving toward leadership in low-emission technologies.

Investment will continue to be needed in energy assets over the coming years and in advance of an effective global response. These investments will involve substantial spending on assets with the potential to last for many decades.

In encouraging the investment needed to meet this demand, government policies on climate change should set a clear framework for decision making that recognises the long-term nature of investments and desire for investment certainty. These policies should recognise that shielding individual projects or sectors from general government policies is rarely efficient or equitable.

Within this framework, investors should be free to manage risk and pursue legitimate commercial opportunities as they see fit. In making commercial judgements about future greenhouse scenarios investors should have regard to the government's policy objective of reducing Australia's greenhouse signature in the longer term. Investment decisions need to have regard to Australia's ongoing commitment to pursuit of effective global action on climate change, and the government's commitment not to introduce an emissions trading scheme in the abscence of an effective global response emerging.

Should such an effective global response be in prospect, the government will consider least-cost approaches to constraining emissions. This consideration would encompass the possible introduction of market-based measures (such as an emissions trading scheme) in the longer term, noting the potential for these to lead a better resource allocation and provide industry and individuals with the greatest flexibility in determining how best to respond.

9

ENERGY AND THE ENVIRONMENT

Key Points

- The Australian Government is committed to improving environmental outcomes while achieving continued economic growth.
- Environmental protection is a shared responsibility: industry, the Australian Government and state and territory governments and the community all have a role to play. The Australian Government takes a leadership role in championing environmental protection and ensuring consistent regulatory and incentive systems are in place to protect the environment.
- The main non-greenhouse environmental impacts from energy use in Australia are urban air pollution, and the impacts of resource developments.
- The Australian Government has a suite of measures in place to address the ongoing challenge of preserving Australia's high urban air quality. Vehicle and fuel standards, fuel efficiency agreements, better consumer information, and support through AusLink for improved traffic management are elements of this dynamic response.
- The Australian Government's approval processes provide a streamlined and efficient mechanism to ensure that nationally significant environmental values are protected while economic development continues. Industry/government collaboration on environmental performance guidelines and practices is reducing the need for complex processes while ensuring effective environmental management.

INTRODUCTION

Economic development and a robust, healthy environment are essential to the welfare of Australians. The Australian Government is committed to ensuring both. Producing and using energy can reduce water and air quality, threaten or endanger native species, contribute to global warming, alter landscapes and generate noise.

Since 1996 the Australian Government has been building a national strategic framework to place Australia on an environmentally sustainable footing for future generations.

The framework represents a concerted effort to move away from ad hoc interventions of the past to standard setting and market-based approaches. It involves designing environment policy that is science-based, results-oriented and that can deliver practical outcomes by working in partnerships with industry, regions and the community. This framework operates from a strong legislative base. The Environment Protection and Biodiversity Conservation Act 1999 provides opportunities for economic development while protecting the environment.

Within the framework the government is actively integrating economic, social and environment considerations. The approach to national energy policy is a key example of economic and environmental policy integration in practice.

Significant air pollution impacts arise from transport use, and an effective system to manage these emissions is in place through measures including national vehicle emission standards and fuel quality standards. Other air pollution sources are largely under the control of state governments.

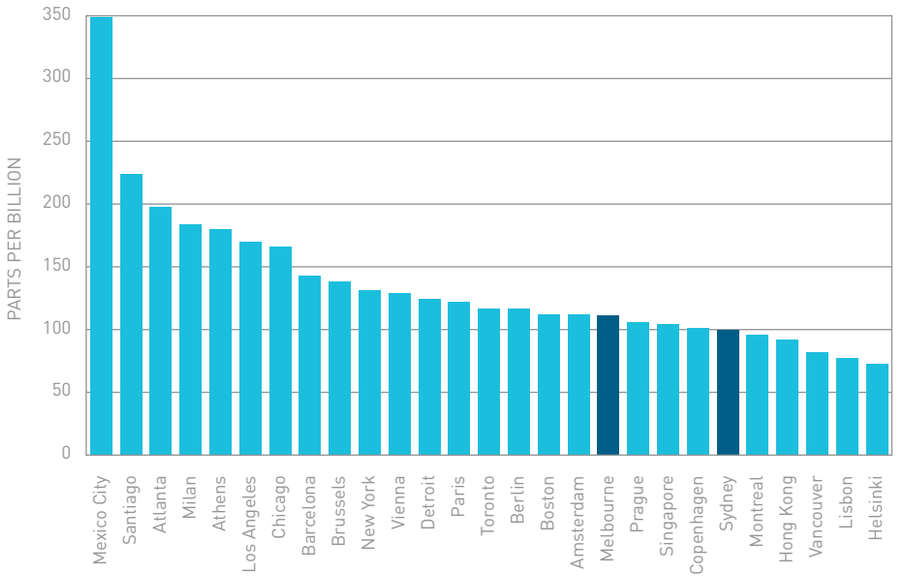
Local impacts from resource development are addressed through environmental impact assessment processes at state and federal level. These processes provide for streamlined approvals that provide greater certainty for industry.

Managing greenhouse gas emissions leading to global warming is a more recent environmental concern and will be a continuing challenge for the long term. This issue is addressed in detail in Chapter 8, Climate change.

AIR QUALITY IMPACTS

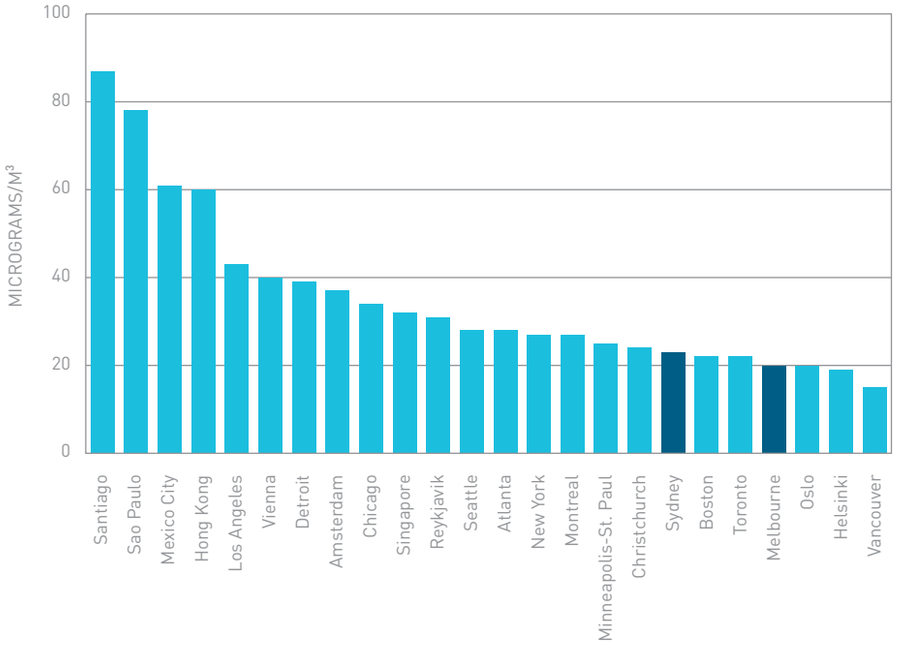
Australia has high urban air quality by international standards (see Figure 1), although some areas and cities (such as Sydney, Melbourne and Perth for one-hour ozone levels in 2001) exceed World Health Organisation limits on some occasions. Air pollution leads to a range of serious health effects, as well as visual pollution and damage to buildings. The health impacts of transport emissions (which account for only a part of total air pollution) in Australian capital cities have been estimated as costing around $3.3 billion per year (BTRE 2003).

Figure 1: Australian air quality is good by world standards—ozone



Note: Figure shows maximum one-hour ozone concentrations in selected cities in 1995.
Source: EPA Victoria 2000 Draft Air Quality Improvement Plan Port Phillip 2000

Figure 2: Australian air quality is good by world standards—particulates



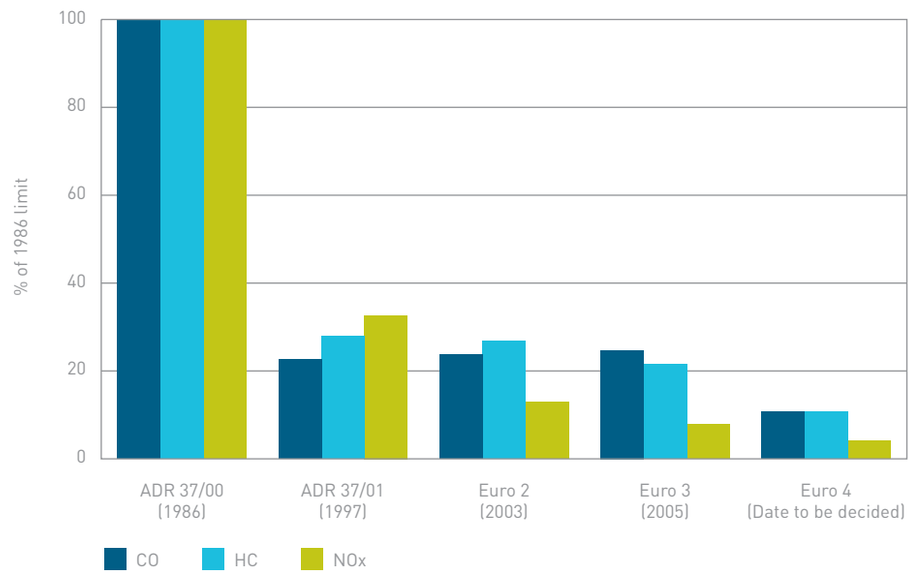
Note: Figure shows annual particulate (PM10) concentrations in selected cities in 1995.
Source: EPA Victoria (2000) Draft Air Quality Improvement Plan Port Phillip 2000

Transport is a major but not the only contributor to urban air pollution. For example, the Victorian Environment Protection Authority found that in the Port Phillip region in 1995–96, transport accounted for 60–85 per cent of emissions of carbon monoxide (CO), oxides of nitrogen (NOx) and benzene, but only 20–40 per cent of particulates and volatile organic compounds (VOCs). Other major sources of pollution were industrial plants (emitting especially particulates and NOx) and residential solid fuel heaters (emitting particulates and VOCs) (EPA Victoria 2000). These different sources of emissions are addressed at different levels of government, with Australian government activity focused on vehicles and fuels, and state governments addressing local licensing conditions. The primary responsibility for managing air quality is with state governments.

Transport

In Australia, progressively tighter vehicle emission standards from 1986 have significantly reduced emissions from vehicles and consequently pollution levels. These reductions in per vehicle emissions from the standards have helped offset the growth in emissions associated with growing road transport activity. However, increasing vehicle ownership and distance travelled indicate a need for ongoing management of air quality. Vehicle emissions standards for the post 2006 period will be decided by the end of 2004.

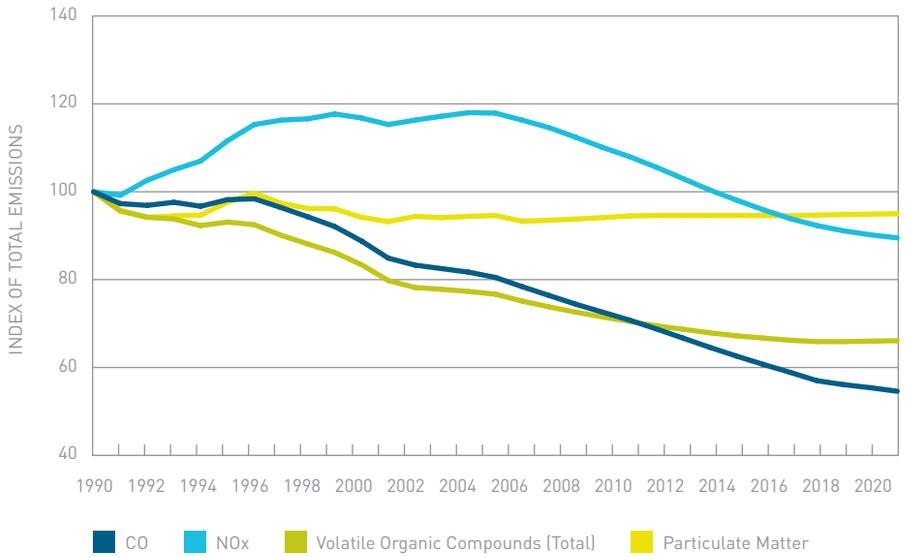
Figure 3: Timing and magnitude of reductions in emission standards for new passenger cars



Since 2002, fuel quality standards have also driven reductions in transport emissions. Standards continue to evolve in line with international practice. The sulphur content of Australian petrol will drop from 500 parts per million (ppm) to 150 ppm from 1 January 2005, and the benzene content will be regulated for the first time to a maximum of one per cent. The sulphur content of Australian diesel will drop from 500 ppm to 50 ppm from 1 January 2006, matching that of European (Euro 4) diesel from that date. The reduction in low sulphur levels will facilitate the introduction of advanced low-emission technology such as direct injection engines and improved catalysts into the Australian market. These vehicle emission and fuel quality standards will play a key role in improving health outcomes (and avoided health costs) and urban amenity.

The government has provided incentives to encourage the early availability of low-sulphur fuels—40 per cent of all diesel now sold in Australia has less than 50 ppm sulphur, compared with the regulated standard of 500 ppm in advance of the mandated date of 1 January 2006. The government will introduce incentives to refiners and importers to encourage the supply of 50 ppm premium unleaded petrol from two years before it is mandated (expected to be 1 January 2008), and diesel with 10 ppm sulphur from two years before it is mandated (expected to be 1 January 2009).

Figure 4: Base case projected growth in major pollutant emissions from motor vehicles for Australian metropolitan areas, 1990–2020



Source: Bureau of Transport and Regional Economics Urban pollutant emissions for motor vehicles: Australian trends to 2020.

These measures will address emissions from all vehicles. However, a small percentage of highly polluting trucks accounts for a significant portion of emissions, with 2 per cent of vehicles accounting for around 10 per cent of truck emissions (FORS 1996). Addressing emissions from these vehicles would deliver substantial environmental benefits. As part of the government's fuel excise reforms, vehicles of 4.5 tonnes or above will be required to demonstrate that they are not high emitters in order to receive diesel fuel business excise credits from 1 July 2006 (see Chapter 5, Fuel excise reform).

In addition, the government has implemented a series of agreements with industry on improving the national average fuel consumption of passenger motor vehicles that should see the average fuel consumption of new Australian vehicles fall from 8.43 litres per 100 km in 1998 to 6.8 litres per 100 km by 2010. The government continues to publish an annual fuel consumption guide for new vehicles, and since 2001 new vehicles have been required to carry a fuel consumption label.

The Australian Government will also widely promote the Green Vehicle Guide, providing a simple, integrated environmental assessment of motor vehicles. This information will allow new car buyers to consider environmental performance in their purchasing decisions and contribute to reducing transport emissions. As part of its Government Operations programme, the Australian Government will ensure ongoing improvement in the environmental performance of its fleet as indicated by this guide.

Air quality in the long term can also be improved by the use of public transport and better management of traffic flow in congested areas. AusLink's scope encompasses improved transport and traffic management systems. Improvements in information technology have allowed development of intelligent transport systems, including adaptive traffic control systems, freeway management and information systems, electronic fare collection, in-vehicle navigation and information, and advanced traveller information systems. These systems can lead to significant reductions in fuel usage and hence emissions, as well as reducing travel times for Australians and improving economic efficiency. A new national intelligent transport strategy is currently being developed under the auspices of the Australian Transport Council. This will provide a framework for the development and uptake of intelligent transport systems in Australia and assist in addressing cross-modal, cross-industry, and cross-jurisdictional issues.

Stationary sources of air pollution

Industrial emissions, including from power generation and oil refining, and residential solid fuel burning—woodheaters and open fires—are also significant contributors to air pollution in specific locations. The setting of national air quality standards, state and territory regulation of emissions from industrial and commercial facilities, and new woodheater emission standards and incentive programmes to replace older high-emitting woodheaters work together to support the solid progress being made in managing emissions from transport.

The National Environment Protection Measure (NEPM) for Ambient Air Quality and the recently developed NEPM for Air Toxics set national benchmarks for air quality for a range of pollutants. States and territories have the key responsibility for putting in place strategies to meet these national standards. Governments will continue to update national air quality standards and monitor environmental emissions through the National Pollutant Inventory, to secure cost-effective improvements in air quality.

ENVIRONMENTAL IMPACTS OF ENERGY PROJECTS

Many potential environmental impacts in the energy sector are site-specific from particular resource development projects. These include issues such as marine impacts from offshore oil exploration and processing, effects on biodiversity from mining, and salinity impacts of water use by power stations. Efficient development of Australia's energy resources depends on a competitive regulatory framework that is effective, easy to understand and does not impose excessive compliance costs on proponents, while ensuring effective environmental management.

Australian government assessment of impacts

At the Australian government level, the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides protection for matters of national environmental significance while providing certainty for industry. These goals are primarily achieved through streamlined, transparent and efficient environment assessments and approvals that apply to projects likely to have a substantial impact on matters of environmental significance. The EPBC Act improves on previous processes by setting out clear areas of responsibility, identifying specific timeframes for completion, and coordinating state, territory and Australian government processes. Energy projects are also subject to licensing requirements under state and territory laws including for the release of emissions, and sometimes to local government planning approvals.

Matters of national environmental significance covered by the EPBC Act are:

- world heritage properties
- national heritage places
- Ramsar wetlands of international importance
- nationally threatened animal and plant species and ecological communities
- internationally protected migratory species
- Commonwealth marine areas
- nuclear actions.

The EPBC Act also protects the environment on Commonwealth land and regulates the operational activites (not government policies) of Australian government departments and agencies that may have a significant impact on the environment.

Development proponents, through interaction with the Department of the Environment and Heritage, are able to incorporate specific environment protection measures during the project design stage and prior to making a referral. This can result in removing the need for assessment and approval under the Act. Where projects require EPBC approval, the Department of the Environment and Heritage works with the proponent and other relevant interests to identify solutions that mitigate or avoid impacts. When approving a project, the Minister for the Environment and Heritage may set conditions that safeguard the matters of national environmental significance. The Act requires that the Australian Government Minister for the Environment and Heritage must consider relevant social and economic matters together with environmental impacts when making an approval decision. This could include, for example, conditions for compensating actions where environmental impacts can not be avoided but the project has significant social or economic benefits.

The EPBC Act provides for the strategic assessment of a policy, plan or programme. The minister must consider information arising from a strategic assessment when deciding whether or not an action requires assessment and approval under the EPBC Act and what level of assessment is appropriate. This allows for more industry certainty while managing environmental impacts (see Box).

EXAMPLES OF ENERGY PROJECTS ASSESSED UNDER THE EPBC ACT

Example 1: Offshore oil and gas projects

A number of offshore oil and gas exploration and development proposals have been assessed and approved under the EPBC Act, generally due to the likely impact on the Commonwealth marine environment and listed migratory species. This includes issues such as potential impact of oil spills and discharges of waste water, drilling fluids, hydrotest water and produced formation water on the Commonwealth marine environment, and the potential impacts of noise on listed threatened cetacean species. Generally, approval conditions require proponents to prepare environment management plans: for example, oil spill contingency, marine impact and decommissioning plans.

In cooperation with the offshore oil and gas exploration industry, the Department of the Environment and Heritage has developed guidelines on the application of the EPBC Act to interactions between offshore seismic operations and larger cetaceans. Some offshore oil and gas seismic exploration survey proposals have not required approval because they are to be conducted in accordance with the guidelines.

Greater certainty for the offshore petroleum exploration industry is being provided through a strategic assessment of offshore exploration and appraisal activities being developed by the Department of Industry, Tourism and Resources, which the Minister for the Environment and Heritage must consider when deciding whether or not an action requires assessment and approval. The assessment will examine the principal sources of impacts on matters of national environmental significance of proposed petroleum exploration and appraisal, and strategically identify concrete and effective measures for mitigating these impacts.

Example 2: Wind farms

The construction and operation of a number of wind farms have been assessed and approved under the EPBC Act, as a result of concerns over likely impacts on listed threatened species and listed migratory species. Approval conditions typically require proponents to prepare environment management plans for the repair or mitigation of damage to the habitat of listed species. Such plans can require details of measures to minimise risk of bird collision and electrocution, and details on vegetation and listed species management. Monitoring of bird strikes and other measures also can be required.

The Department of the Environment and Heritage is working with a technical reference group to increase knowledge and understanding of the potential impacts of wind farms on birds and bats. Guidelines are being prepared for development of low-impact wind energy facilities, and funds have been provided to prepare data set standards and protocols for the measurement of wind farm impacts on specified species of birds and bats.

Under the EPBC Act, duplication between Commonwealth and state assessment processes is reduced via bilateral agreements which accredit state assessment processes and in some circumstances give the state responsibility for the approval decision. The Act also allows for case-by-case accreditation of state and territory environmental assessment processes. The EPBC Act sets clear timeframes for decision making, supporting more certain investment planning.

The environmental impacts of energy resource development activities in Commonwealth marine waters are addressed under Australia's Oceans Policy. The progressive development of regional marine plans for all Australian waters provides for the development of resources while ensuring the protection of marine biodiversity. The government regards regional marine planning as a key element of its long-term energy policy framework, given the significant petroleum and gas resources located in Australian waters.

All offshore petroleum activities in Australian Commonwealth waters are also regulated by the Petroleum (Submerged Lands) Act 1967 (the PSL Act). Regardless of approval under the EPBC Act, proponents must receive approval under the PSL Act prior to an offshore petroleum exploration and development activity being undertaken. This Act is responsible for monitoring the day-to-day operation of all offshore petroleum exploration and development activities. In particular, regulations require the submission of an environmental plan. This plan must include: a detailed description of the environment and relevant risks and effects; relevant environmental legislation; environmental performance objectives, standards and criteria; an implementation strategy (including an Oil Spill Contingency Plan and an Emergency Response Plan); reporting arrangements; and consultation regime.

The Department of Industry, Tourism and Resources is undertaking a review of the current environmental Regulations under the Petroleum (Submerged Lands) Act. The review, which includes stakeholders from industry, government and the environmental community, has the object of continuing to promote multiple use of Australia's marine resources and set industry best-practice standards for environmental regulation.

LOOKING FORWARD

The Australian Government has put in place effective frameworks to manage its environmental responsibilities. A suite of measures exists to address the ongoing challenge of preserving Australia's high air quality, including continuing improvements in vehicle and fuel standards, agreements with industry to improve vehicle fuel efficiency and better consumer information. The AusLink package will deliver improved traffic systems to address the growing volume of transport demand, and the government will continue to monitor levels of pollution to ensure these responses remain well-targeted and effective.

Transparent, cooperative and timely approval processes are essential, and provide clear signals for investment. The Australian Government will continue to work with industry to develop agreed environmental guidelines and practices that support efficient and sustainable investment.

State and territory governments also play a central role in managing environmental impacts, especially in relation to traffic management and more localised project impacts. The Australian Government will continue to provide national leadership on environmental management and effectively meet its responsibilities, in cooperation with other governments to achieve high levels of environmental quality.

10

INNOVATION

BUILDING A BRIDGE TO THE FUTURE

Key Points

- Innovation and new technologies are vital to addressing both the competitiveness of the Australian economy and environmental issues, especially climate change.
- Energy sector innovation occurs in both processes and technologies and covers the full spectrum from concept identification through research and development to commercialisation and uptake. Government policies respond to different needs at different stages.
- Australia's relatively small size in the global economy means it cannot be a leader in all technologies; an assessment of strategic interests identified the following broad categories of energy technologies:
  - market leaders—technologies with strategic importance for Australia that international efforts will not adequately address, or in which Australia has a clear technology advantage
  - fast followers—technologies where Australia has a strategic interest but where domestic efforts should focus on supplementing international developments, and adopting these technologies quickly when available
  - reserve—technologies in which Australia has a lesser strategic interest at this stage.
- The Australian Government's innovation support system for energy is comprehensive and effective, and is responding to the government's identified National Research Priorities. The May 2004 statement, Backing Australia's Ability—Building our future through science and innovation, provided additional funding of $5.3 billion to support Australian science and innovation.
- Recognising the importance of technology to Australia's long-term greenhouse response, the Australian Government will also:
  - establish a $500 million Low-Emission Technology Fund to demonstrate technologies that can contribute substantially to greenhouse emissions reductions in the longer term and $100 million to support development of smaller-scale renewable energy technologies
  - implement Solar Cities trials to demonstrate the economic and environmental benefits of concentrated applications of distributed generation and energy efficiency in an efficient market context
  - provide $34 million in new funding to address specific barriers impeding the uptake of renewable energy.

INTRODUCTION

Innovation and new technologies are vital to achieving our energy goals. Ongoing innovation is important to maintaining the productivity and competitiveness of the energy sector. Increased efficiency in energy supply and use, more efficient exploration and exploitation of energy resources and innovative energy applications are required to support strong economic development.

Addressing environmental objectives, especially reducing greenhouse gas emissions, also requires innovation and technology development. Australia could meet a large part of its energy needs today through low or zero emissions sources of energy. But the cost would be large and would entail significant disruption to existing economic structures. Technology offers an opportunity to develop low emissions solutions at a more competitive cost.

The Australian Government plays an active role in encouraging businesses and households to develop and take up innovative approaches and technologies.

WHAT IS ENERGY INNOVATION?

Innovation occurs in processes and practices, not just technologies. A factory can use high-efficiency equipment but still waste energy if the flow-through processes from one stage to the next are not well integrated.

Innovation includes both supply and use of energy. There is strong evidence that Australians could save a lot of money by using energy more efficiently, both at home and in business. These savings can come through both better practices and technological approaches including high-efficiency equipment, smart metering and energy-efficient alternative production and processing methods (e.g. microwave drying).

Innovation is a complex process involving concept identification, research and development (R&D), commercial demonstration, learning by doing and widespread adoption. Gains from new innovations are realised only with widespread adoption, which generally lags the original concept by a long period of time. For example, several decades passed before gas turbines that were derived from military jet engines improved in efficiency and reliability to the point that they were cost-effective for electricity generation.

GOVERNMENT SUPPORT FOR INNOVATION

Innovation is a necessary element of a modern, dynamic economy. Innovation is important as it can deliver productivity growth, create new industries and provide solutions to environmental and other social problems.

This was the basis for the government's release in 2001 of Backing Australia's Ability (BAA), and in May 2004 of Backing Australia's Ability—Building our future through science and innovation (BAA2). Together, these policies will provide $8.3 billion in support for science and innovation over 10 years. This is the largest ever investment in Australian innovation.

BAA and BAA2 target the three key elements of the innovation system:

- Strengthening Australia's ability to Generate Ideas and Undertake Research
- Accelerating the Commercialisation of Ideas
- Developing and Retaining Skills

As well as increasing the level of government support for Australia's innovation effort, BAA and BAA2 have made the innovation system much more responsive to the needs of the community and industry. National Research Priorities were announced in 2002 to focus research and development (R&D) on strategic priorities for Australia. CSIRO has implemented a set of research flagships, more closely focusing the efforts of Australia's premier science organisation on integrated approaches to issues of major significance. Research centres have been established in a number of key areas, and the Cooperative Research Centres programme has been re-focused to ensure effective partnerships with industry and researchers. Effective R&D tax concessions have been extended to smaller firms, and greater government support is available to small firms making the transition to domestic and global competition.

The energy sector is an important target in Australia's innovation efforts. As well as being the direct basis of major industries (e.g. electricity, LNG exports, coal mining, photovoltaic manufacture, etc), energy provides necessary inputs to all Australian businesses and households. Productivity-enhancing innovations in energy can flow through quickly to the economy as a whole. Innovation in end use technologies can make industry more competitive.

Energy innovation is also vital to meeting Australian environmental objectives. The energy sector is a major contributor to urban air pollution. While improved fuel and vehicle standards have generally improved air quality in Australian cities, the continuing rapid growth in transport volume means further technological improvement will be required for continued effective management of traffic-based pollution over the long term.

Energy supply and use accounted for 55 per cent of net national greenhouse emissions in 1990, growing to 68 per cent by 2002. Even with significant abatement in non-energy sectors, Australia's ability to meet long-term greenhouse objectives is tied to its ability to manage energy sector emissions. To do this while also encouraging continued economic development requires technologies that can deliver significant reductions in the energy intensity of the economy and the greenhouse intensity of energy supply.

GOVERNMENT SUPPORT FOR ENERGY INNOVATION

Recognising the importance of energy to Australia's economic and social objectives, the Australian Government has provided substantial innovation support to this sector. In 2001–02[1], the government spent $223 million on energy sector innovation, including nearly five per cent of the science and innovation budget. In addition, excise exemptions for alternative transport fuels cost more than $800 million in foregone revenue, mostly for LPG. Government regulations including the Mandatory Renewable Energy Target (MRET) and Minimum Energy Performance Standards also drive significant private sector expenditure on innovative energy supply and use.

Table 1 summarises the major sources of government support for energy innovation. The classification into different parts of the innovation spectrum has a degree of arbitrariness. Many programmes run across more than one part of the system; Cooperative Research Centres (CRCs), for example, support R&D as well as commercialisation activities.

Government programmes target different needs at different stages of innovation. For example, both the R&D Start Programme and the Renewable Energy Commercialisation Program have provided assistance at different times to a current project in South Australia developing 'hot dry rock' technologies—a possible baseload source of low emissions electricity. Should the current trial prove successful, the resulting electricity generation could receive further assistance through participation in the MRET. The Australian innovation system has been responsive to the project at different stages of the journey from initial concept to practical uptake.

1. The latest year for which comprehensive sectoral data is available. University funding is for 2001 calendar year.

Table 1: Major programs of government support for energy innovation

	Research and development	Commercialisation/ Demonstration	Uptake
General innovation programmes	University Funding R&D Tax Concession Australian Research Council Grants R&D Start/Commercial Ready Cooperative Research Centres CSIRO	Pooled Development Funds Innovation Investment Funds Cooperative Research Centres COMET R&D Start Commercial Ready	Greenhouse Gas Abatement Programme
Energy specific	Elements of GeoScience Australia	Renewable Energy Commercialisation Program Renewable Energy Equity Fund	Fuel Excise Concessions (LPG, biofuels, shale oil) Remote Renewable Power Generation Programme Photovoltaic Rebate Programme Mandatory Renewable Energy Target* Minimum Energy Performance Standards*

* While there is some government administrative expenditure, these are regulatory programs that drive innovation largely funded by industry and consumers.

Significant areas of Australian Government support for energy innovation include:

- the research priority goal, 'reducing and capturing emissions in transport and energy generation', provides a context and focus for Australia's broader innovation effort.
- 'Energy transformed' is one of six CSIRO flagship research programmes, and has an overall goal of the cost effective reduction of greenhouse gas emissions from the energy sector. BAA2 provided $305 million in additional funding for CSIRO flagships.
- a range of CRCs deal directly or indirectly with energy issues. Three CRCs are developing advanced black and brown coal combustion technologies, and information on capturing and storing greenhouse emissions from power stations, all geared to improving the greenhouse performance of Australia's energy system.

  The CRC for Mining Technology and Equipment supports improvements in efficiency and profitability of this sector, the Rail CRC supports more cost-effective rail transport, and many manufacturing CRCs conduct work on manufacturing processes and materials that can reduce energy needs in meeting consumer demands.

- ARC funding for a Key Centre for Photovoltaic Engineering at the UNSW and the Centre for Sustainable Energy Systems at ANU. Australia continues to develop leading edge solar technologies, including high efficiency applications such as sliver cells that can significantly reduce production costs.
- significant investment, estimated at more than $2 billion by 2010, in new renewable energy technologies due to the MRET. While not focused on developing new technologies, the MRET has driven cost reductions through learning by doing, and addressed soft infrastructure issues such as standards, accreditation and appropriate market structures.

In addition to programmes specifically designed to promote new technologies and innovation, the Strategic Investment Coordination Process has provided substantial support for projects that will have an ancillary benefit of promoting new technologies in Australia. For example, the government's $125 million Strategic Investment Coordination grant for Rio Tinto's HIsmelt project supports a technology that can reduce greenhouse emissions and waste in iron and steel production, with important benefits for productivity and competitiveness. Similarly, Visy's Tumut paper mill, which received a $36 million SIC grant, uses a technology that increases profitability, reduces emissions, increases recycling and reduces water use per tonne of paper.

Overall, the Australian Government spends more on promoting uptake of technologies than on R&D or commercialisation, although generally this expenditure is not directly aimed at developing new technologies. Government uptake support can be important in underpinning market penetration in the early stages when cost reductions through learning by doing are most significant. However, such support can be expensive, and such support is best targeted at broad outcomes rather than specific technologies to reach them.

AUSTRALIA'S PLACE IN GLOBAL ENERGY INNOVATION

Australia accounts for 0.3 per cent of global population, 1 per cent of world trade and GDP, and 2 per cent of global patents. The government's support for innovation recognises that Australia cannot be a leader in all technologies, but must carefully consider its unique needs and capacities. This is not intended to devalue the important role Australian R&D can play, but to place it in a broader context where important technology innovation is increasingly global.

The government assessed a broad range of energy-related technologies in this context, using criteria related to technical feasibility, likely development costs, strategic benefits, the role of government, and methods of effective support. This resulted in three broad categories of technologies, recognising that there are sub-elements of each technology that may require separate assessment.

First are those technologies in which Australia has a strategic interest, can not rely on international activity (e.g. because the technology is geographically or resource dependent) and/or has a sustainable technological edge. For example, advanced brown coal combustion technologies are unlikely to be quickly advanced overseas, but are important to maintaining the long-term viability of Australia's large brown coal resource. Australia has world-leading research in certain aspects of photovoltaics and significant potential for domestic uptake and export potential. These technologies deserve high priority in government support ('market leadership').

Second are technologies where Australia has a specific interest in development, but there are significant international development activities of direct relevance to Australia's needs. For example, advanced black coal power generation is important to Australia's future since black coal delivers more than half of electricity and is a major export earner. However, this technology requires large capital investments in R&D. As other countries with a similar reliance on coal (especially the United States) are investing heavily in this technology, and the technology will be transferable to a large degree, Australia should participate in these developments to the level needed to understand them in detail, ensure Australian interests are considered and be positioned to adapt them to Australian circumstances. This 'fast follower' approach requires active engagement in international forums (bilateral and multilateral), the capability to select and adapt technology, including systems integration, and a domestic R&D effort sufficient for Australia to effectively participate in international collaborations.

Finally, there are technology developments where Australia currently lacks a clear and strong strategic interest in making significant investments in near-term development. For example, while hydrogen technology is likely to be an important international innovation in the longer term, it does not directly and immediately affect Australia's strategic interests, except insofar as it is a possible output of some advanced coal technologies. Such 'reserve' technologies may develop a higher priority in future, and Australia needs to focus on niche opportunities and stay abreast of international developments.

Even though hydrogen is classed in the 'reserve' category, the Australian Government recognises that Australia should be prepared for a possible transition to a hydrogen economy in the long term, and there will be significant opportunities and challenges. In particular, the government understands the importance of maintaining a close interest in the development of international standards for the hydrogen economy in order to ensure these do not inhibit Australian participation or uptake of new technologies. Following the completion of the National Hydrogen Study in 2003, Australia has joined the United States, Japan, European nations and others in forming the International Partnership for the Hydrogen Economy, and continues to monitor areas where Australia has niche leadership opportunities.

Table 2 summarises the assessment of technologies falling into different categories based on the issues discussed above (see Annex for summaries of the main reasons for categorisations). These assessments do not override the need for excellence in research. Rather, they provide a strategic backdrop in assessing innovation priorities for energy. These assessments will be incorporated into existing innovation mechanisms over coming years. The government will review these assessments on a regular basis to ensure they respond to international and domestic developments.

Table 2: Technology assessments

Market leader	Fast follower	Reserve
Play a leading role in international R&D efforts.	Strongly position Australia to follow international developments quickly.	Position Australia to monitor international developments and follow as needed.
Energy supply technologies		
Advanced brown coal Geosequestration Hot dry rocks Photovoltaics Remote area power systems Coal mining and extraction	Advanced black coal Natural gas Wind Biomass Wave	Hydrogen Tidal Large-scale hydro Nuclear
Energy demand technologies		
Solid Oxide Fuel Cells	Intelligent transport systems Energy efficiency Advanced conventional vehicles Hybrid electric vehicles	Other fuel cells

INTERNATIONAL COOPERATION

Australia's relatively small economy means that international engagement and collaboration provides an important means for accessing new technology, promoting Australian innovation, and influencing the development and acceptance of new technologies to meet Australian priorities. Key international technology collaborations include:

- participation in international energy technology and policy through the International Energy Agency (IEA)
  - As an IEA member, Australia has access to technology developments and the outcomes of international collaboration in energy technology. The IEA also promotes the development and deployment of energy technologies through a framework of over 40 implementing agreements (IAs). These enable experts from different countries to work collectively and share results, which are usually published. Through participation in IAs, Australia is able to share the cost of research, pool scientific and technical results, access the expertise and training of foreign participants in projects, and demonstrate Australian expertise and skills. Australia is currently a member of 15 IAs, covering renewable energy, fossil fuels, energy end-use and fusion power.
- the APEC Energy Working Group
  - 'facilitating energy technology development, exchange, application and deployment' as one of the group's seven key objectives. It focuses particularly on technologies to provide off-grid electricity supply, an area where Australia has strong expertise.
- a network of bilateral relationships with key trading partners in the energy sector, including Japan, Korea, China, Taiwan, the United States, Indonesia and India
  - The recently completed sales agreement with China in relation to North West Shelf gas includes a major technology collaboration element.
- cooperative arrangements in place with the US, Japan, New Zealand, the European Union and China on climate change activities, including technology development, and active participation in the Carbon Sequestration Leadership Forum and the International Partnership on the Hydrogen Economy
  - These activities recognise the special challenges and opportunities that climate change presents both in terms of domestic abatement and impacts on global energy trade.

While these agreements are well-justified in themselves, they have developed through different forums, and with different focuses of activity. The Australian Government will conduct a review of international energy technology agreements by the end of 2004 to strengthen Australia's contributions and ensure that strategic interests are being met.

ECONOMIC DEVELOPMENT WITH A LOWER EMISSIONS SIGNATURE

Ensuring ongoing productivity and competitiveness in the energy sector will remain a high priority for energy sector innovation, and the current innovation system addresses this well. A particular challenge for energy technology is addressing greenhouse emissions while maintaining economic growth and development. Low-emission technology development is a key element of Australia's long-term climate change response strategy.

The government already has in place a range of measures to address these concerns. As indicated above, many of the existing energy sector innovation activities are focused on addressing greenhouse gas emissions.

However, given the importance of developing low-emission technologies, and the considerable risk and capital cost of demonstrating some of these, the Australian Government will introduce further specific support mechanisms to complement the wider innovation system, as part of a longer-term climate change strategy. In particular the government will establish:

- a $500 million Low-Emission Technology Fund to support demonstration of technologies with the potential to deliver significant energy sector emissions reductions and $100 million to support development of smaller-scale renewable energy technologies.
- Solar Cities trials to provide a working model of how solar technologies, energy efficiency and efficient markets can combine for a sustainable energy future; these trials will address current lack of rewards for the unique characteristics of photovoltaics, and market barriers to energy efficiency.
- $34 million in new funding to address specific barriers to uptake of renewable energy technologies. This includes better wind forecasting capacity, advances in energy storage technologies and strategic development of renewable energy technologies, systems and processes that have strong commercial potential.

These measures are further discussed in Chapter 9—Climate change and energy.

LOOKING FORWARD

Australia has a world-class innovation system, and BAA2 ensures it will remain comprehensive, strong and effective for the future. The Australian government provides significant support for energy sector innovation, including a strong focus on activities to address greenhouse emissions from the energy sector.

In an increasingly integrated world, Australia must ensure it employs its innovation capacities in the way that maximises benefits. Through a further assessment of international cooperation activities, and regular reviews of domestic and international technology development, the government will ensure Australia continues to play a role in global innovation reflecting Australia's excellent and diverse capacities. Combined with a domestic system that is well resourced, and focused on community and industry needs, this will ensure Australia's innovation system continues to support a dynamic and sustainable Australian economy.

ANNEX

Technology Assessments—Rationale

The following provides a brief summary of the key rationale for categorisation of technologies. The key issues relate largely to the strength of international activities, level of Australian leadership in technology development, ease of adapting international technology, and the importance and 'uniqueness' of the relevant resource. As there are many individual components within technologies, this is a broad, strategic assessment only.

Market Leader

Advanced brown coal utilisation—Brown coal accounts for around one quarter of Australian electricity generation and has the highest greenhouse intensity of electricity options. Australia has large reserves of cheap brown coal. Coal of this type is used in only a few countries so there is limited international research and development to support long-term use of this fuel.

Geosequestration—This technology is the key to low emissions use of fossil fuels. Local geology is central to the performance of sequestration sites. Identifying, characterising and evaluating domestic storage locations is a key part of developing the technology.

Hot dry rocks—This is one of the more prospective base load renewable electricity generation options. Australia's hot dry rock resource is the best in the world, although much is distant from markets. Domestic geology determines accessibility and potential.

Photovoltaics—Australia has world-leading research in this technology. Australia's climate, settlement patterns and electricity use profile offer a supportive environment for uptake. Demand for this technology in the Asia Pacific region is potentially large.

Remote area power systems—Australia has technology leadership in integrating and installing integrated systems. Australia is one of few industrialised countries with significant remote settlements. Demand for this technology in the Asia Pacific region is potentially large.

Coal mining and extraction—Coal provides more than three quarters of electricity generation and significant exports. These technologies are central to continued competitiveness. Australia's coal resources tend to have special characteristics such as thick seams and being amenable to open cut extraction. Other industrialised countries cannot be relied on to develop technologies appropriate to our needs.

Solid Oxide Fuel Cells— Australia has world-leading technology. Fuel cells offer significant potential for moving to more distributed electricity generation.

Fast follower

Advanced black coal utilisation—Black coal accounts for more than one half of Australian electricity generation, and significant exports. There are significant international R&D efforts in this area, which are likely to be adaptable to Australia. A major focus of research is on combining these technologies with carbon capture and storage; this integration work is often treated better as geosequestration R&D activity.

Natural gas utilisation—Gas is projected to increase its share of electricity generation, and Australia has significant reserves and exports. Gas technologies are easily adapted internationally. No significant breakthroughs in this technology are currently foreseen.

Wind—Use of wind is increasing rapidly in Australia and internationally, and there are significant overseas R&D efforts. Australia imports most wind technologies, which require little or no local adaptation.

Biomass—Technologies to use biomass are well-established and easily transferred. Domestic issue tend to relate to resource access rather than combustion/generation technologies. Technologies to use waste materials may deliver lower costs.

Wave—Some international R&D on this technology is taking place. Australia has potentially large wave resources located close to load.

Intelligent transport systems—Technologies are being developed overseas, but will require local adaptation. The key issue for the Australian Government is when and how to encourage inter-operability of systems.

Energy efficiency—Australia does not have technological leadership in these technologies, but the importance of energy to the economy indicates a need to demonstrate and take up such technologies when available.

Advanced conventional vehicles—The global auto industry is investing heavily in developing these technologies. The nature of the Australian auto industry does not support a leading edge position in this area, but new technologies will need to be taken up to meet consumer demand.

Hybrid electric vehicles—As per Advanced conventional vehicles, although Australia does not currently produce hybrid vehicles.

Solar Thermal—This is promising technology that can meet heat as well as electricity needs. Development of this technology is relatively rapid and Australia has important niche areas of expertise.

Reserve Technologies

Hydrogen—There is considerable international R&D effort in this area. While offering long-term potential, the commercial use of hydrogen is a distant prospect. Concerns over fuel security and air quality driving hydrogen development internationally are of less pressing concern in Australia. As an island, Australia also does not have concerns over integrating with other countries' infrastructure. Niche opportunities exist for Australia.

Tidal—There are very few sites globally with the conditions needed to make tidal power practical. Tidal resources in Australia are located mostly distant from major energy users. Use of this resource would therefore require extensive transmission or transformation investment. Tidal power technologies should be easily transferable internationally.

Large scale hydro—There is limited potential for further large-scale hydro in Australia, especially close to significant energy users This technology is easily adapted to local conditions.

Nuclear—The international R&D effort on nuclear technologies is massive. The Australian government is not contemplating the use of nuclear energy in Australia.

Fuel cells—International R&D efforts on fuel cells are significant. While Australia's leadership on solid oxide cells places this niche into the market leader category, other technologies will continue to be driven internationally. No adaptation for local conditions is required.

SUMMARY OF MEASURES

INTRODUCTION

Securing Australia's Energy Future provides details of a range of new programmes and measures in the energy sector. These new initiatives augment other programmes and measures previously announced by the government. This appendix is not intended to provide a comprehensive list of all government initiatives related to energy, but to list the new initiatives announced in this Energy White Paper (new initiatives underlined) and other energy related programmes and measures announced since the formation of the Energy Committee of Cabinet in March 2003 and discussed in the White Paper.

2. DEVELOPING AUSTRALIA'S ENERGY RESOURCES

Petroleum resource rent tax—providing an immediate uplift for exploration expenditure in designated offshore frontier areas

	2004-05	2005-06	2006-07	2007-08
Revenue ($m)	-	-2.0	-6.0	-9.0

The government has increased the value of pre-appraisal exploration deductions in designated frontier areas from 100 per cent to 150 percent for determination of the Petroleum Resource Rent Tax.

Pre-competitive data on energy resources

The Australian Government will develop protocols to guide the collection of comprehensive and consistent pre-competitive data for energy resources, covering both mineral and renewable energy sources.

Geoscience Australia—Core Petroleum Programme

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	8.9	9.1	9.3	-

The government is providing $36 million to Geoscience Australia between 2003-04 and 2006-07 to continue with the existing pre-competitive oil exploration programme.

Geoscience Australia—Seismic Data Acquisition and Preservation

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	5.0	7.5	10.0	-

The government is providing $25 million to Geoscience Australia between 2003-04 and 2006-07 for the collection of new seismic data, including in offshore frontier areas, and the preservation of existing data.

Strategic Investment Incentive to GTL Resources

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	26.8	8.0	-	-

The government will provide funding of $35.4 million over three years for the development of common user infrastructure on the Burrup Peninsula in Western Australia to encourage further investment in the region. The infrastructure will initially support GTL Resources' $700 million methanol plant on the Burrup Peninsula and will be available to other future projects in the region.

National Offshore Petroleum Safety Authority

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	2.0	-	-	-

The Australian Government will establish a single national authority to improve regulation of safety in the Australian offshore petroleum industry. The National Offshore Petroleum Safety Authority will commence operations on 1 January 2005.

Protocols for projecting greenhouse emissions from resource development projects

The government will develop with and seek agreement of the states and territories by end 2004 to a national protocol to provide for the accurate projection of greenhouse gas emissions by project proponents, and encouragement for early consultation between project proponents and relevant environmental agencies.

Greenhouse Challenge for Large Energy Projects

(described under Climate Change and Energy)

Wind forecasting capability

(described under Climate Change and Energy)

3. ENERGY MARKETS—DELIVERING AUSTRALIA'S ELECTRICITY AND GAS NEEDS

Ministerial Council on Energy—Response to the COAG Energy Market Review

Australian governments have set out a major programme of market reform in recent months. This programme embraces governance and regulation, transmission planning, energy user participation, and increasing natural gas penetration.

- On governance, the Ministerial Council on Energy (MCE) will become the single national energy market governance body, underpinned by a national legislative framework.
- Regulation was addressed through commitments to rapidly establish two new national institutions, the Australian Energy Market Commission, with responsibility for rule making and market development, and the Australian Energy Regulator, to administer market regulation. These two agencies will replace 17 current regulators.
- A suite of new developments address electricity transmission planning, including: a new transmission planning function, a new regulatory test for transmission investments, new processes for determining wholesale market regional boundaries, and market based incentives for transmission performance. An Annual National Transmission Statement, outlining needs and opportunities, will be published, with the first in July 2004.
- User participation is to be addressed through alignment of retail price caps with costs, plus examination of demand side response pools and interval metering.
- On gas penetration, the MCE committed to responding to the Productivity Commission Review of the National Gas Access Regime, expected in June 2004.

Australian Energy Market Commission

The Australian Energy Market Commission is to be established in legislation on 1 July 2004 and will have responsibility for market development and rule making for national electricity and gas markets.

Australian Energy Regulator

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	6.5	-	-	-
Capital ($m)	1.9	-	-	-

The Australian Energy Regulator (AER) will be established in legislation on 1 July 2004. The government will provide $8.4 million in 2004-05 (including $1.9 million capital funding) to fund the AER to conduct day-to-day regulation of national gas and electricity markets.

Solar Cities

(described under Climate Change and Energy)

Improving grid accessibility

(described under Climate Change and Energy)

4. ENERGY MARKETS—DELIVERING AUSTRALIA'S TRANSPORT FUELS

Alternative fuels

The government has implemented a framework of measures to support the use and production of alternative fuels in Australia. These measures include excise concessions currently costing $840 million a year in forgone excise revenue (mostly from LPG sales) and a $1000 grant for LPG vehicles delivered new between 1 July 2011 and 30 June 2014. (see also measures under Fuel Excise Reform)

Biofuels Capital Grants Program

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	37.6	-	-	-

The government has established a $37.6 million capital fund to fund one-off capital grants for projects that provide new or expanded biofuels production capacity. Grants will be provided at a rate of 16 cents per litre to projects producing a minimum of 5 million litres of biofuels per year, up to a maximum of $10 million per project.

Fuel Quality Standards

(described under Energy and the Environment)

AusLink redirection of Fuel Sales Grants Scheme

(described under Fuel Excise Reform)

Petroleum Products Freight Subsidy Scheme

(described under Fuel Excise Reform)

5. FUEL EXCISE REFORM

Fuel Excise Reform—Business Credits

The fuel excise reform measures detailed below will, in total, effectively reduce fuel excise collections from businesses and households by around $100 million in 2006-07, $350 million in 2008-09 and $310 million in 2012-13, totalling about $1.5 billion over the whole period.

Extension of full excise credit for all business use of fuel off-road

A full excise credit will be introduced for all business use of fuel off-road. This measure will be phased in for newly eligible activities, with a 50 per cent credit being provided for fuel excise incurred in these activities from 1 July 2008 and a full credit from 1 July 2012. Credits will apply to all taxable fuels, including petrol, used in these activities. This measure is expected to reduce the excise collections from businesses (in addition to the grants provided for electricity generation) by $320 million in 2008-09, increasing to $650 million in 2012-13.

Extension of full credit for fuels used in electricity generation

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	-	-	140.0	140.0

Diesel and fuel oil used for power generation will be effectively excise-free from 1 July 2006. There will be no excise introduced on currently untaxed fuels used for power generation.

Removal of excise on burner fuels

	2004-05	2005-06	2006-07	2007-08
Revenue ($m)	-	-	-60.0	-60.0

The 7.557 cent per litre excise on burner fuels (like heating oil and kerosene) will be removed from 1 July 2006. Excise will apply to these fuels when used in an internal combustion engine.

Removal of grants on burner fuels

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	-	-	-50.0	-50.0

Grants to offset excise on burner fuels under the off-road component of the Energy Grants Credits Scheme will be removed from 1 July 2006.

Conversion of partial excise for fuel used in heavy vehicles to a road user charge

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	-	-	-180.0	-220.0

The net excise paid on fuels used on-road for business purposes in heavy vehicles (those with a gross vehicle mass of 4.5 tonnes or more) will be converted into a non-hypothecated road user charge from 1 July 2006.

Removal of metropolitan boundaries and extension of on-road credits to all fuels

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	-	-	130.0	130.0

The metropolitan boundaries that govern eligibility for excise credits for heavy diesel vehicles will be removed and on-road credits will be extended to all taxable fuels used in heavy vehicles, including petrol, from 1 July 2006.

Conditional excise credits for heavy diesel vehicles

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	1.2	0.4	-	-

From 1 July 2006, eligibility for excise credits for diesel used on-road in heavy vehicles by businesses will be conditional on those vehicles meeting at least one of five specified emission-performance criteria.

Conditional excise credits for large energy users
(described under Climate Change and Energy)

AusLink
The government is allocating $11.8 billion for road and rail transport over the five years to 2008-2009. This includes $7.7 billion in land transport funding for the AusLink National Network, $1.45 billion for the Roads to Recovery programme, $2.55 billion for Financial Assistance Grants for roads and $90 million for the National Black Spot programme.

Single business credit system
The government will introduce a single business credit system. Excise credits will be claimable through the Business Activity Statement in the same way as GST credits from 1 July 2006.

Energy content based fuel excise system
The government has deferred the introduction of the energy content based excise system for fuels capable of use in an internal combustion engine until 1 July 2011. The measure will ensure that alternative fuels that are effectively untaxed under the current excise regime remain so until 1 July 2011.

Under the new system, from 1 July 2011 alternative fuels will receive a 50 per cent discount on the full energy content rate, with the excise rates phased in equally over five years to their final rate on 1 July 2015. In addition, all fuels will be grouped into three bands based on their energy content, with different rates for high, medium and low-energy fuels. Excise on petrol and diesel will remain unchanged.

AusLink redirection of Fuel Sales Grants Scheme

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	-	-	-265.0	-270.0

The Fuel Sales Grants Scheme will cease after 30 June 2006. Funds will be allocated to the new land transport infrastructure programme, AusLink, to improve roads in outer metropolitan, rural and remote areas.

Petroleum Products Freight Subsidy Scheme

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	-	-	-4.0	-4.0

The Petroleum Products Freight Subsidy Scheme will cease after 30 June 2006.

6. ENERGY EFFICIENCY

Mandatory energy efficiency opportunity assessments

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	2.2	3.7	3.9	3.7

All businesses using more than 0.5 petajoules of energy per year will be required to undertake an energy efficiency opportunity assessment every five years and report publicly on energy efficiency opportunities with 1, 2, 3 and 4 year paybacks. This funding will support development of assessment and reporting standards, and to disseminate the lessons learned to other businesses. A further $3.3 million will be provided in 2008-09, bringing total funding to $16.9 million.

Climate Change Strategy—Action on energy efficiency

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	5.5	6.7	7.2	7.2

The government will provide funding of $26.7 million over four years to increase the uptake of cost-effective and technically proven energy efficiency opportunities across the economy. This includes continuation and enhancement of energy efficiency labelling, Minimum Energy Performance Standards for appliances and equipment and buildings, and improvements to the energy efficiency of government operations.

Buildings
The government will support the use of nationally consistent energy performance ratings for commercial and residential buildings by requiring that landlords and owners disclose energy performance to prospective tenants or purchasers.
The government will seek the cooperation of the states and territories to implement these changes. Funding for this measure is included in Climate Change Strategy—Action on energy efficiency, above.

Solar Cities
(described under Climate Change and Energy)

Productivity Commission inquiry
The government will commission the Productivity Commission to undertake a review of the scope and paths to greater energy efficiency to be completed by mid-2005.

7. ENERGY SECURITY

Investing in Australia's Security—critical infrastructure protection

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	0.9	1.4	1.2	0.5

The government will provide $4 million to support work on improving the security of Australia's energy infrastructure.

Gas Emergency Response Protocols
The Ministerial Council on Energy is developing emergency response protocols for the gas sector, including its interaction with electricity supplies, based on the Moomba experience at the beginning of 2004. This project, due to be completed in December 2004, will involve substantial industry and user consultation.

Liquid Fuel Emergency Response Plan
Australian governments, in cooperation with industry, have developed the Liquid Fuel Emergency Response Plan. The plan was tested during a simulation exercise in June 2003. In April 2004, the Ministerial Council on Energy agreed to establish an Energy Security Working Group, as an umbrella under which the National Oil Supplies Emergency Committee will have ongoing responsibility for managing the National Liquid Fuel Emergency Response Plan. The Australian Government is reviewing the Liquid Fuels Emergency Act 1984 to ensure it is best practice in emergency management.

Review of the outlook for national energy security
The government will undertake a biennial review of the national energy security outlook. This review will consider the adequacy of existing policy and our international commitments and obligations.

8. CLIMATE CHANGE AND ENERGY

Low Emissions Technology Demonstration Fund

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	1.5	1.8	51.8	51.6

The government will establish a $500 million Low Emissions Technology Fund to support industry-led projects for large-scale demonstration of low emissions technologies that could reduce the cost of technologies with significant long-term abatement potential. The fund will leverage a further $1 billion or more in investment from industry. Total funding will be $522.9 million including administration costs.

Renewable energy development initiative
The government will provide $100 million over seven years to support strategically important renewable energy initiatives with strong commercial and smaller emissions-reduction potential. Funding will be comprised of $50 million from the Commercial Ready programme, and $50 million in new funding.

Solar Cities

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	2.1	5.9	21.2	24.6

The government will provide $75.3 million to fund a series of trials to gauge the benefits of the concerted use of solar and energy efficient technologies combined with interval metering. These trials will provide a working model of how sustainable energy systems can work in the future. They build on Australian leadership in solar technologies and will place value on the benefits of solar energy in reducing the need for peak generation and distribution infrastructure.

Climate Change Strategy—continuing administration of the Mandatory Renewable Energy Target

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	2.6	2.7	2.7	2.6
Revenue ($m)	0.5	0.6	0.7	0.9

The government will continue to support the uptake of low emission energy from renewable sources through the Mandatory Renewable Energy Target (MRET). The government will also support improved transparency and administration of the MRET.

Climate Change Strategy—Action on energy efficiency
(described under Energy Efficiency)

Mandatory energy efficiency opportunity assessments
(described under Energy Efficiency)

Greenhouse Challenge—Challenge Plus—Industry Partnerships

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	6.7	6.9	8.8	8.8

The government will provide funding of $31.3 million over four years to extend and strengthen the Greenhouse Challenge and related partnership programmes. In addition to a new tiered structure allowing committed companies to demonstrate leadership, this White Paper includes the following enhancements:

- from 1 July 2006, businesses receiving fuel excise credits of more than $3 million per year will be required to be members of the Greenhouse Challenge programme.
- large energy resource development projects above a certain size will be required to be members of Greenhouse Challenge

Climate Change Strategy—Low emissions technology and abatement

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	3.2	5.7	9.0	9.0

The government will provide funding of $26.9 million over four years to encourage ongoing investment in the development, demonstration and deployment of smaller-scale low emission technologies, and other cost-effective abatement activities.

Climate Change Strategy—local greenhouse action

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	2.5	3.2	3.6	3.8

The government will provide funding of $13.2 million over four years to engage local government and the community in identifying and implementing practical actions to reduce greenhouse gas emissions.

Advanced electricity storage technologies

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	0.8	3.7	5.8	5.8

The government will provide $20.4 million for the development of advanced storage systems for electricity from intermittent generation systems.

Wind forecasting capability

The government will provide up to $14 million to support the development of a wind forecasting system and software for Australian conditions.

Improving grid accessibility

The Australian Government will work with the states and territories to identify by December 2005, and respond to, specific rule changes required in the National Electricity Market to maximise the benefits of distributed generation.

9. ENERGY AND THE ENVIRONMENT

Fuel quality standards

The government has implemented fuel quality standard setting processes with the aim of broadly aligning Australian fuel quality parameters with international standards. The first tranche of Australian standards for petrol and diesel are being progressively introduced between 1 January 2002 and 2006. A second tranche of Australian standards was announced in the 2003-04 Budget.

Cleaner fuel incentives

The government has provided incentives to refiners and importers to offset the higher costs of producing cleaner fuels and to bring forward supplies of 50 ppm sulphur diesel in advance of the mandated date of 1 January 2006 to capture early environmental benefits. A second phase of incentives will encourage the early supply of 50 ppm sulphur premium unleaded petrol and 10 ppm sulphur diesel two years before the mandated dates for these fuels (currently anticipated to be 1 January 2008 and 1 January 2009 respectively).

Green Vehicle Guide—promotion

	2004-05	2005-06	2006-07	2007-08
Expense ($m)	1.1	0.2	0.1	0.1

The Australian Government will encourage purchasers of new passenger cars to help achieve cleaner air and lower greenhouse gas emissions by producing and promoting a Green Vehicles Guide and making it widely available.

10. INNOVATION—BUILDING A BRIDGE TO THE FUTURE

Backing Australia's Ability

In May 2004, the Australian Government announced Backing Australia's Ability—Building our Future through Science and Innovation (BAA2). The government will provide an additional $5.3 billion for science and innovation over the next seven years, the largest ever funding increase for science and innovation in Australia.

Low Emissions Technology Demonstration Fund

(described under Climate Change and Energy)

Renewable energy development initiative

(described under Climate Change and Energy)

Solar Cities

(described under Climate Change and Energy)

Wind forecasting capability

(described under Climate Change and Energy)

Advanced electricity storage technologies

(described under Climate Change and Energy)

Technology assessments

The government has developed a comprehensive set of technology assessments to provide a guide to priority setting and decision making with regard to energy innovation. These assessments will be incorporated into existing innovation mechanisms over coming years. The government will review these assessments on a regular basis to ensure they respond to international and domestic developments.

International energy technology agreements

The Australian Government will conduct a review of international energy technology agreements by the end of 2004, to ensure a strategic focus on international cooperation is retained.

ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABCB	Australian Building Codes Board
ABGR	Australian Building Greenhouse Rating
ABS	Australian Bureau of statistics
ACCC	Australian Competition and Consumer Commission
ACT	Australian Capital Territory
ADR	Australian Design Rule
AEMC	Australian Energy Market Commission
AGO	Australian Greenhouse Office
ANU	Australian National University
ANZSES	Australia and New Zealand Solar Energy Society
APEC	Asia-Pacific Economic Cooperation
ARC	Australian Research Council
ATO	Australian Taxation Office
BAA	Backing Australia's ability 2001
BAA2	Backing Australia's ability—Building our future through science and innovation May 2004
BCSE	Business Council for Sustainable Energy
BTRE	Bureau of Transport and Regional Economics
C/MJ	cents per metajoule
CCGT	Combined cycle gas turbine
CNG	Compressed natural gas
CO	Carbon monoxide
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
COAG	Council of Australian Governments
COMET	Commercialising Emerging Technologies
CPL	Cents per litre
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EBIT	Earning before interest and taxes

EMR	Energy Market Reform
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESAA	Electricity Supply Association of Australia
ESI	Energy Security Initiative
EU	European Union
EURO	European
FPSO	Floating production storage and offtake
FSGS	Fuel Sales Grant Scheme
GAS Code	National Third-Party Access Regime for Natural Gas Pipelines
GDP	gross domestic product
GST	Goods and Services Tax
GTL	gas to liquids
GVM	gross vehicle mass
GWH	gigawatt hours
IA	implementing agreement
IAEA	International Atomic Energy Agency
IDGCC	Intergrated dewatered gasification combined cycle
IEA	International Energy Agency
IGCC	Integrated gasification combined cycle
IPCC	Intergovernmental Panel on Climate Change
KG	Kilogram
KM	kilometre
KT	thousand tonnes
KV	kilovolts
KW	Kilowatt
LETS	Low Emissions Technology Scheme
LFE Act	Liquid Fuel Emergency Act 1984
LNG	liquefied natural gas
LPG	liquefied petroleum gas
M/S	Metres per second
MB/D	millions of barrels per day
MCMPR	Ministerial Council on Mineral and Petroleum Resources
MEAA	Minerals Exploration Action Agenda
MEPS	minimum energy performance standards
MJ	megajoule
ML	megalitre
MRET	Mandatory Renewable Energy Target
MT	million tonnes
MTBE	Methyl tertiary butyl ether
MW	megawatt
MWH	megawatt hours

N/A	Not applicable
NEA	Nuclear Energy Agency
NEM	National Electricity Market
NEMMCO	National Electricty Market Management Company Ltd
NEPM	National Environment Protection Measure
NFEE	National Framework on Energy Efficiency
NGCC	Natural gas combined cycle
NOX	nitrous oxide
NSW	New South Wales
NWS	North west shelf
OECD	Organisation for Economic Cooperation and Development
OPEC	Organisation of Petroleum Exporting Companies
ORF	Other refinery feedstock
PARER REVIEW	Towards a truly national and efficient energy market— Council of Australian Governments Energy Market Review Final Report
PJ	petajoules
PM	Particulate matter
PNG	Papua New Guinea
PPM	parts per million
PROSSER INQUIRY	2003 Report of the House of Representatives Standing Committee on Industry and Resources Inquiry into impediments to increasing investment in mineral and petroleum exploration in Australia
PRRT	Petroleum Resource Rent Tax
PSL Act	Petroleum (Submerged Lands) Act 1967
PV	photovoltaic
QLD	Queensland
R&D	research and development
SA	South Australia
SC	Supercritical
SEA GAS	South-east Australian gas pipeline
SIC	Strategic Investment Coordination
TCM	trillion cubic metres
TWH	terawatt hour
UK	United Kingdom
UN	United Nations
UNSW	University of New South Wales
US DOE	United States Department of Energy
USA	United States of America
USC	Ultra-supercritical
VIC	Victoria
VOC	volatile organic compound
WA	Western Australia
WRI	World Resources Institute

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