Australian Government
Department of Resources, Energy and Tourism

ENHANCING AUSTRALIA'S ECONOMIC PROSPERITY

ENERGYWHITEPAPER

National Energy Policy—Framework 2030

STRATEGIC DIRECTIONS PAPER

Department of Resources, Energy and Tourism

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1. INTRODUCTION

Energy in its many forms underpins the modern economy. It powers industrial production, transport, telecommunications and IT systems. It underpins our way of life by enabling the services of the modern home, such as refrigeration, cooking, heating, air conditioning and entertainment.

Our economic and social dependence on energy is often taken for granted. The energy sector makes a substantial contribution to economic and social wellbeing and generates billions of dollars in export income. Yet the sector faces significant and growing pressures, now and into the future, which will fundamentally affect the way we produce and consume energy resources.

In particular, growth in world demand for energy has stretched supply capability. Rapidly changing economic and climatic conditions have seen the amplification of price volatility. Economic dependence on energy has highlighted the importance of supply chain reliability and risks to the supply chain from economic and political instability. At the same time, fossil fuel use is largely responsible for levels of greenhouse gases which threaten changes to the global climate system with environmental consequences that cannot be ignored. The financing of investment in energy infrastructure has become more challenging. Far-reaching community expectations about the production, transformation and use of energy, the technologies to be employed, and the social, environmental and economic impacts need to be taken into account.

It is more important than ever before that Australia's energy policies be positioned to meet these global challenges and opportunities. Consequently, the government proposes to develop an energy policy to ensure Australia's long-term energy security to meet the needs of the economy overall and underpin the prosperity and wellbeing of all Australians.

The energy policy will be set out in a White Paper ('the Energy White Paper') scheduled to be released at the end of 2009. The Energy White Paper will identify a comprehensive policy framework that will be durable to 2030 and beyond, yet be flexible and adaptable to meet new challenges and opportunities as they arise. This will include short- to medium-term actions for government and industry.

The purpose of this document is to set the scene for the development of the Energy White Paper by broadly mapping out its intended scope and identifying some of the specific work being undertaken as input for consideration. The release of this document will be followed by the release of a series of detailed discussion papers in March and April 2009. The discussion papers will address international energy; realising Australia's energy resource potential; the legal, institutional and governance framework; competitive markets, structural reform and investment; maximising the value of technology in the energy sector; and our people, demographics, workforce and Indigenous participation.

An Energy Green Paper in mid-2009 will set out a draft National Energy Policy Framework. Submissions from the business sector, state governments and the broader community on the discussion papers and Energy Green Paper will be considered in the development of the Energy White Paper.

To assist the government in its deliberations, a high-level reference group—the High Level Consultative Committee—has been established.

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More information about the Energy White Paper is available at www.ret.gov.au

2. APPROACH AND SCOPE

The government's Energy White Paper will be developed against policy principles whose consistent application will ensure that the National Energy Policy Framework enhances the overall welfare of Australians. The proposed principles are:

a) economic development is sustainable and efficient

b) effective operation of competitive energy markets is promoted

c) the need and scope for government intervention on the basis of market failure is identified

d) international and national interests and obligations are met.

To foster an appreciation of the challenges for a National Energy Policy Framework and an understanding of the directions adopted in the Energy White Paper, policy development will be undertaken in an open and transparent manner with regular and comprehensive consultation across all levels of government, industry and the broader community.

The Minister for Resources and Energy and his department, which has responsibility for the development of the Energy White Paper, will actively engage with stakeholder groups to ensure that all issues are effectively explored. The department will also ensure that the energy policy is: fully consistent with other aspects of government policy, particularly the government's commitments to reductions in greenhouse emissions through the Carbon Pollution Reduction Scheme (CPRS); other greenhouse response measures, such as the Renewable Energy Target; any decisions on the Review of Export Policies and Programs (Mortimer Review) and the Review of the National Innovation System; and, inform the Review of Australia's Taxation System, the National Low Emissions Coal Council's National Low Emissions Coal Strategy, and Infrastructure Australia's strategic blueprint for future infrastructure needs.

The Energy White Paper will consider energy issues from both the supply and demand sides. On the supply side it will cover energy resources, sources and carbon sinks, including energy exploration and development; energy conversion; carbon capture, injection and storage; energy transmission, distribution and retailing; investment; energy trade; energy-related technologies and services; infrastructure needs; and capacity building and skills. Key areas of focus in the use of energy will include energy consumption, energy efficiency, the role of demand-side participation in energy markets, and behavioural change. The development and enhancement of competitive energy markets will be a key consideration.

The Energy White Paper will focus on the advancement of Australia's interests as an energy exporter and importer and the protection and enhancement of our energy security. It will encompass energy demand and use in Australia and globally; the utilisation of our energy resource endowment; and the exercise of strategic international leadership in collaboration with our energy partners, particularly in our region, in advancing our interests. Our interests include our capacity to achieve prosperity through:

- exports of competitively marketed energy resources
- meeting our domestic energy requirements cost-effectively and securely while meeting environmental objectives.

The Energy White Paper will identify an appropriate mix of energy policies to deal with the uncertainties, risks and opportunities to secure cleaner, adequate, reliable and affordable supplies of energy to support our overall economic and social advancement. In this context:

- *cleaner* energy supports environmental objectives
- *adequate* energy is sufficient to support economic and social activity
- *reliable* energy is supplied with minimal disruptions
- *affordable* energy is supplied at a price that does not reduce the competitiveness of the economy and that supports continued investment in the energy sector.

3. GLOBAL ENERGY CONTEXT

In *World Energy Outlook 2008*, the International Energy Agency (IEA) referred to the world's energy system as being at a crossroads, with current global trends in energy supply and consumption that are patently unsustainable—environmentally, economically and socially. The IEA identifies a need for an energy revolution to address two central energy challenges: securing the supply of reliable and affordable energy; and effecting a rapid transformation to a low-carbon, efficient and environmentally responsible system of energy supply.

The IEA states that global demand for energy could rise by 45 per cent in the period from 2006 to 2030 on a business-as-usual basis. Global carbon intensity—that is, tonnes of energy-related carbon dioxide (CO_2) emitted compared to gross domestic product (GDP) at constant purchasing power parity—is projected to decline significantly over the same period, but energy-related CO_2 emissions will continue to rise in absolute terms. Non-OECD countries account for most (97 per cent) of the rise in world emissions through to 2030, and for 87 per cent of the increase in global energy demand. On a business-as-usual basis, China and India are forecast to account for just over half the increase in global energy demand to 2030; along with the Middle East, they will account for 75 per cent of growth in global energy emissions.

The IEA argues that global energy security and climate change challenges cannot be addressed without a radical reorientation of the global energy system to substantially reduce its carbon intensity—nothing short of an 'energy revolution'. The significance of this challenge for global prosperity and wellbeing cannot be overstated. The global economy and existing energy technologies face a fundamental shift in incentives that will drive structural reform, alter the basis of commercial activity—including the type, timing, size and location of investments—and present a range of new business opportunities.

Negotiations for a new international climate change agreement are in progress under the United Nations Framework Convention on Climate Change and its Kyoto Protocol. The negotiations aim to culminate at the end of the next negotiating round, at the end of 2009. To craft a robust and effective international agreement in this timeframe will be challenging. There is, however, strong international recognition that climate change poses profound economic, social and environmental threats that must be tackled rapidly.

Oil, coal and natural gas are likely to remain the main fuel sources used globally to 2030, despite increases in the use of nuclear and renewable energy.

While energy prices are lower during the current global economic slowdown, the IEA notes that energy prices will remain volatile and higher crude oil prices are expected in the longer term. Global oil production is not expected to peak before 2030, but a lack of timely investment, especially in the upstream oil sector, could create very tight supply–demand balances by the middle of the next decade. Further, increasing concentration of reserves among national oil companies and in politically unstable regions is likely to magnify the risk of investment delays. This, like a range of other scenarios, may have implications for oil-importing countries like Australia. The impact of such scenarios will depend upon the diversity of crude oil import sources, our indigenous crude oil endowment, and the extent to which other domestic energy sources, such as natural gas, coal and renewable energies, are substitutable for oil, and the pace of that substitution.

Globally, the demand for liquefied natural gas (LNG) has been strong, with a number of new projects able to deliver additional LNG in the near term experiencing buoyant markets. In the longer term, the demand for LNG from new projects is expected to be strong, but supplies are expected to be concentrated in a few countries and projects. If investments in new LNG projects falter for any reason, lower gas supply could result in greater use of coal. Greater use of coal will result in higher global CO_2 emissions in the absence of integrated carbon capture, injection and storage. Under the IEA reference scenario, coal is expected to increase its share of global energy demand to 2030, with the bulk of growth coming from electricity generation in China and India.

Energy price volatility has been apparent during the global economic crisis. Current global investment cutbacks and delays in exploration and development in the energy resources sector, in petroleum refining and distribution facilities, and in new technologies—consequences of the economic crisis—may well reduce capacity to meet future energy challenges. In the current global economic environment, a lack of market confidence that future tight supply–demand balances might be avoided is encouraging national state-owned companies to take a direct role in projects to enhance control of the output.

Similar circumstances are influencing the incentives for investment in the coal and natural gas sectors, as well as in electricity generation.

These pressures and uncertainties pose challenges for Australia's energy security through to 2030 and beyond, including through impacts on the affordability of energy, imports of oil and liquid fuels, and domestic gas and electricity supplies.

4. THE AUSTRALIAN ENERGY CONTEXT

Australia has many advantages as a destination for investment in energy and energy-intensive industries, particularly its relative openness to investment, stable government, system of laws, and transparent and competitive energy markets. It has established a reputation as a reliable, commercial, market-based and globally competitive energy exporter.

However, Australia is increasingly subject to rapidly changing global and domestic energy market conditions, which bring both challenges and opportunities. The strategic energy security issues currently facing Australia and those posing a potential risk in five years (2013), 10 years (2018) and 15 years (2023) are identified by the National Energy Security Assessment (March 2009).

4.1 Economic contribution

Australia's energy resource endowments have contributed to the development of a range of energy-intensive industries and allowed us to become a net exporter of energy—our export trade in energy is dominated by coal[1], LNG and uranium. While we export significant quantities of very high value crude oil and condensate, we are a net importer of liquid fuels. Our natural resource endowments have also provided us with a relatively inexpensive and reliable supply of electricity.

The sector employs around 1 per cent of the Australian labour force. The value of Australia's net energy exports has grown in real terms by an average 5 per cent a year over the past 20 years to around $38 billion in 2006–07. The value of energy imports has grown by an average of 8.8 per cent over the same period to around $22 billion.

We are the world's second largest thermal coal exporter, accounting for around 20 per cent of world trade. Coal is Australia's largest export commodity, making up approximately 18 per cent of all merchandise exports and with a value approaching $38 billion for the 12 months ending October 2008. Australia has a largely coal-based electricity generation sector—in 2006-07 over 81 per cent of our electricity production was based on thermal coal, 12 per cent from natural gas, 6 per cent from hydro, and less than 1 per cent from oil and other fuels.

Australia is also the world's second largest uranium exporter and a significant exporter of LNG and energy-related services and technologies. There are several new LNG projects around Australia at various stages of planning and development.

Over the past 10 years, primary energy consumption in Australia has grown at an average annual rate of 2.1 per cent to 5770 petajoules in 2006–07. Reflecting our relatively high standard of living, Australia is ranked ninth in the world in the consumption of primary energy on a per person basis. Australian primary energy consumption is predominantly of petroleum and coal, but the share of natural gas has risen to 20 per cent over the past 30 years. Almost 80 per cent of primary energy consumption is accounted for by electricity generation, transport and manufacturing. The transport sector accounts for 35 per cent of final energy use but 70 per cent of liquid fuels, indicating the vulnerability of that sector in particular to liquid fuels disruptions.

A range of policy measures have been introduced to support the take-up and development of all renewable energy sources. Under a national Renewable Energy Target (RET), the government will require that 20 per cent of power generation comes from renewable energy sources. The RET guarantees a market for renewable

[1] 'Coal' refers to both thermal and metallurgical coal, unless otherwise specified.

energy based electricity generation using a mechanism of tradeable renewable energy certificates. The government is also supporting renewable energy development through initiatives that complement the RET scheme by encouraging research, demonstration and commercialisation of renewable energy, in particular the $500 million Renewable Energy Fund, $150 million for solar and clean energy research, and more than $500 million for the Solar Cities, National Solar Schools and Green Precincts initiatives.

Nearly 10 per cent of total research and development in Australia was devoted to energy research in 2006–07, of which nearly 75 per cent focused on the mining and extraction of energy resources.

The reliable and affordable delivery of energy to consumers relies on avoiding disruption to Australia's domestic energy markets and our energy supply chains. Although we import increasing amounts of our requirements for oil and petroleum products, our access to competitive international markets and efficient supply chain management have generally ensured secure and reliable liquid fuel supplies.

4.2 Resource endowment

We have an abundant and diverse resource endowment, including extensive reserves of coal, natural gas, uranium and renewable energy sources. We have about two-fifths of the world's known low-cost uranium reserves. We also have significant crude oil and condensate resources. In addition, Australia's renewable energy sources, including solar, geothermal, wind and wave energy, could be further developed given the right market conditions.

However, we have limited knowledge of Australia's full energy resource potential. For example, some 70 per cent of Australia's sedimentary basins are unexplored for petroleum, geothermal resources are still poorly mapped, and we know little about the size of our exploitable wave and tidal marine resources or the capacity of our geology to accept greenhouse gas injection and storage for the very long term.

Development costs in Australia have been an ongoing challenge for the commercialisation of some energy resources, and potential projects need to achieve a balance between planned capital and operating costs, revenue, and taxation that will deliver an internationally competitive return on investment under a range of likely market conditions.

4.3 Infrastructure

Australia is remote from its international export markets and from the supply sources of its major energy imports. Even Australia's major energy sources to meet domestic demand are generally remote from large population centres and other energy load centres, such as refineries and mines. Consequently, Australia's prosperity is highly dependent on the logistics of energy transport and energy transformation systems to match energy sources with domestic and international customers' needs. Infrastructure to support energy transport includes ports, shipping, rail, energy networks (transmission networks of pipelines and high-tension electricity wires), and distribution and retail businesses. Energy infrastructure to transform primary energy includes electricity generators, petroleum refineries and LNG plant.

Much of Australia's energy infrastructure is privately owned, although in the power supply sector a significant proportion of assets remains in government ownership. The energy sector operates under competitive market arrangements, although some assets with natural monopoly characteristics (including most electricity and gas networks, rail and some ports) have aspects of their business, such as their tariffs or rates of return, determined by state and federal regulatory authorities. There is a need to ensure that there are adequate incentives for investment in infrastructure and that, as far as possible, open and transparent competitive markets govern the provision and price of energy services.

4.4 Lower carbon economy

Australia has committed to reducing greenhouse gas emissions by 60 per cent from 2000 levels by 2050 and to meeting a medium-term national target to reduce emissions by between 5 per cent and 15 per cent below 2000 levels by the end of 2020. The 5 per cent target is a minimum (unconditional) commitment, while the 15 per cent target will apply in the context of global agreement in which all major economies commit to

substantially restraining emissions and all developed countries take on comparable reductions to that of Australia. To achieve this, the government has committed to introducing the CPRS in 2010. The government has also committed to complementary measures, including initiatives to accelerate the development of carbon capture, injection and storage, renewable energy technologies and energy efficiency investments.

The CPRS, as a market-based solution, is the lowest cost way to move to a lower carbon economy while protecting the interests of business and households. It will drive investment in new technologies that will support continued economic growth. In introducing the CPRS, the Government has also committed to provide substantial assistance to Australia's important emissions-intensive trade-exposed industries. This assistance will support these industries moving to a lower carbon economy and will support their continued growth in Australia.

4.5 Geopolitics

Australia is a developed country with an open economy. We have been a stable and reliable supplier of energy commodities, and have developed our energy exports on the basis of long-term stable commercial arrangements with customers. Access to affordable and reliable energy supplies is essential for countries to achieve many of their economic and social development goals.

Historically, Australia has two main energy security interests. The first relates to continuing access to open and competitive international markets for crude oil and petroleum products, particularly as our level of self-sufficiency has declined. The second interest is derived from our status as a major exporter of coal, uranium and gas. This status has made promoting ourselves as a stable and reliable supplier of energy commodities important. In the future, there may also be scope to use our energy resources potential to exercise greater influence in international discussions, in cooperation with our Asia-Pacific trading partners.

5. POLICY CHALLENGES

The new policy framework will need to be fixed in an understanding of the potential of Australia’s energy resource endowment and the Government's lower-carbon policy framework that has now been announced—Australia’s Low Pollution Future. A predictable and integrated policy framework is required to ensure that the energy sector continues to underpin the economic prosperity and wellbeing of all Australians. This section summarises considerations and issues that might be expected to be part of the comprehensive Energy White Paper. It is intended that all aspects of energy policy, from supply through to end use, will be subject to consideration.

The policy challenges outlined here will provide the basis for public consultation in March and April 2009.

5.1 International energy

Governments everywhere are vitally interested in energy security because they recognise the importance of energy to economic prosperity. ‘Energy security’ broadly refers to the ability to obtain cleaner, adequate, reliable and affordable supplies of energy over the long term, whether from domestic or foreign sources.

Energy security concerns vary from country to country, depending on the domestic resource base as well as strategic, political, economic and other factors. Therefore, the interests and policy approaches adopted by different countries vary considerably and are not always well aligned.

Australia’s oil production and refining capacity have been declining. We rely increasingly on imports of crude oil and its derivative products and consequently have a strong interest in global action to sustain competitive international markets and efficient supply-chain management.

Our status as a net exporter of energy and our willingness to adopt a strong 2050 greenhouse gas emissions reduction target, among other factors, are potential sources of influence in international energy matters. Our commitment to provide leadership in critical areas of strong interest to Australia, such as through the establishment of the Global Carbon Capture and Storage Institute to promote the injection and storage of

greenhouse gases, will also raise our profile as a good partner in the development of technologies and science. Export of Australian expertise and services in energy efficiency, renewable energies and carbon capture, injection and storage will help promote Australia's global climate change goals, and will promote prosperity by deriving export income.

The following examples and recent events illustrate some of these issues and show how Australia's interests can be affected by international developments:

- access to finance—the current global downturn is changing the traditional sources of finance and may limit foreign bank participation in syndicates financing large-scale Australian energy projects
- direct investments by foreign enterprises — this investment must be consistent with Australia's national interests
- ongoing access to overseas oil refining and port facilities—some two-thirds of Australia's imported refined petroleum products is currently sourced from Singapore (about 20 per cent of refined product demand)
- major oil producers—oil sourced from outside Australia and Asia is likely to become increasingly important, making political stability in major global producer countries and regions paramount
- political decisions of states, or actions by international organisations or groups, may disrupt or restrict access to crude oil and petroleum products
- disruption of international markets or restricted access—political decisions of states, international organisations or groups (terrorists, pirates) may disrupt or restrict access to such markets
- challenges to our Exclusive Economic Zone—ownership and rights of access to resources in offshore areas can be disputed by neighbouring countries
- uranium exports—Australia's commitment to nuclear non-proliferation and nuclear safeguards arrangements must be managed
- climate change—energy policies, actions and attitudes of individual countries will be altered by responses to climate change and create new alliances.

In considering these and other issues in this area, the Energy White Paper may consider:

a) opportunities for and threats to Australia arising from geopolitical factors, including possible instability in the region, that affect energy supply and energy security

b) measures to enhance the operation of the open and transparent international energy, trade and financial markets

c) multilateral, regional and bilateral partnerships and cooperative arrangements that best advance Australia's interests

d) opportunities for Australia to leverage influence within the Asia–Pacific region through its large energy resources and its position as an exporter.

5.2 Realising Australia's energy resource potential

Developing and diversifying our use of energy resources will be critical to enhancing Australia's energy security. It will give us more choices about how we maintain our competitiveness and energy security in a carbon-constrained world.

Energy resources include oil, gas (conventional and coal seam gas), coal, uranium, renewable energy from currently deployed technologies (hydro, wind and solar), and emerging energy resources, such as geothermal. Non-conventional energy resources that require further technology development for commercial exploitation include oil shale, tight gas sands, hydrate resources, deep coals (underground gasification), marine energy (renewable wave and tidal power), and thorium.

Maximising the value of energy resources will enhance Australia's economic prosperity. This is best achieved by expanding the production of Australia's energy resources to meet domestic and international demand and

by adding value to those resources where it is economic to do so. Competitively priced and reliable energy services will also remain an important contributor to the competitiveness of Australian business.

As we develop and diversify our energy resources, we will mature emerging technologies and services—creating the opportunity to supply them to other markets. These technologies and services will also aid the growth of other sectors of the economy, beyond the energy resources sector, by increasing the capacity of the economy overall.

However, having explored only 30 per cent of its prospective sedimentary basins, Australia does not yet have complete knowledge of its resources, particularly in recently acquired economic zones. This is particularly true for the oil and gas sectors. In addition, further exploration is required for energy resource options that reduce CO_2 or assist in carbon management, such as geothermal systems, coal seam gas, and geological structures that might be suitable for the sequestration of greenhouse gases.

A predictable, flexible and resilient commercial and regulatory environment is essential to encourage exploration and development. Measures that reduce exploration risks to investors can assist to expand the areas of exploration and levels of activity. An internationally competitive and efficient fiscal regime that balances the interests of investors and the community in sharing returns is also essential. Associated tax issues are being considered in the context of the government's Review of Australia's Taxation System. The outcomes of the review affecting the energy resources sector will be integrated into the Energy White Paper.

Energy resource projects create a high demand for supporting infrastructure, which places large financial demands on business and government. Delays in providing infrastructure or inappropriate regulations governing its operation could delay or impede projects and damage customers' perceptions of supply reliability. There may be scope to enhance infrastructure investment and use.

In considering these and other issues in this area, the Energy White Paper may consider:

a) strengthening the economic and scientific data on Australia's energy resource potential by undertaking resource assessments

b) a plan to ensure Australia remains a preferred destination for investment and encourage Australia's established energy exports, including LNG, and associated services

c) an assessment of whether there are efficient and effective legislation and administrative frameworks for the identification, exploration and development of energy resources

d) arrangements to improve the provision, expansion, regulation, ownership arrangements and utilisation of infrastructure.

5.3 Governance, institutional, legal and regulatory frameworks and community engagement

Government energy policy is translated into specific areas of action through laws and regulations and administered through institutions, including government departments, agencies and regulatory bodies. Laws provide a framework, both supportive and constraining, within which all parties operate. It is essential that governments at all levels ensure that these laws and institutional arrangements remain flexible, up to date and relevant, and that principles of good governance apply.

Australia's constitutional arrangements provide for a sharing of powers between the Commonwealth and the states. It has long been recognised that different legislation, regulations and administrative arrangements can give rise to overlapping roles and responsibilities, increasing the regulatory burden for business.

Complex legislation and administrative frameworks are involved in the regulation and taxation of exploration, development, production, transport and use of energy. Differing state and territory rules and regulations have produced some fragmentation of Australia's energy market into sub-markets along geographical boundaries and across sectors. Considerable work has been done to reduce this problem in the gas, electricity and liquid fuels systems, but more work is needed to produce a consistent, national market. Fragmentation increases business costs and prevents energy-sector businesses from operating as efficiently and flexibly as possible.

Higher costs flow through the economy, affecting energy-intensive industries most heavily, and have the greatest impact on those operating in global markets and subject to strong competitive pressures. Addressing this problem is therefore of considerable importance to national productivity and economic performance in the long term.

In considering these and related issues, the Energy White Paper may consider:

a) reviews of legislative arrangements to ensure that they are relevant, up to date, representative of best regulatory practice, and consistent with government policy objectives

b) adjustments to institutional arrangements to ensure compliance with good governance principles

c) legislative amendments and cooperative agreements between and across levels of government to resolve overlapping and inconsistent legislative arrangements

d) the international competitiveness and efficiency of the current fiscal regime applying to the energy sector.

5.4 Investment, competitive markets and structural reform

Australia requires ongoing investment right across the energy sector, from exploration, development and upstream production to transportation and delivery to the end user, as well as in supporting infrastructure, increasing energy productivity, demand-side participation and innovation to improve the use of infrastructure. This includes Greenfield investment as well as significant investment in ongoing maintenance and upgrading of facilities. Adjustments may be required to policy and market settings if investment in the energy sector in Australia is to be optimal into the future. Failure to get settings right will undermine investment and weaken economic growth prospects.

The energy sector is highly capital intensive and for the most part is dominated by relatively few companies, many of which operate globally. For firms operating in global markets, there is strong competition for investment funding between projects in Australia and those located overseas. A range of factors determine Australia's relative attractiveness as an investment destination.

Areas that have been pointed to as undermining Australia's relative attractiveness as an investment destination include the complexity, intrusiveness and cost of regulations; the timeliness of regulatory decision-making; and overlapping regulation within and between different levels of government. The level of government backing for the infrastructure needed to support projects has also been a source of contention. The continuation of government alongside private sector ownership in the electricity sector has been criticised as a source of market distortion. Government ownership, regulation and rates of return earned on infrastructure such as ports, rail and energy networks have been contentious. All of these factors require consideration.

Well-functioning, competitive global and domestic markets generally provide the most suitable basis for optimal and timely investment decision-making. Australia has little capacity to influence world markets, and our interests might be best served by encouraging transparent, efficient markets and enhancing cooperation with external customers and suppliers. Policy settings should consider means to maintain and strengthen our ability to respond to disruptions, structural change and demand fluctuations. Efforts to insulate Australia from integrated global markets and price conditions or to achieve predefined levels of self-sufficiency might be counterproductive and undermine investment decision-making.

Domestic markets for electricity, gas and petroleum products generally operate to maximise the efficiency of investment, operations and the use of energy. Considerable structural reform has taken place in Australia's electricity and gas markets over the past two decades as part of a broader competition reform agenda. Petroleum product markets have been largely deregulated over the same period, resulting in strong levels of market competition. Reforms to domestic energy markets in many areas continue. We need to evaluate the pace and direction of those energy market reform activities.

While Australia's petroleum refineries are smaller than the new regional competitor refineries, they are effective by regional standards. We need to assess the declining trend in our refinery capacity, our level of fuel storage and the cost impacts in the context of maintaining Australia's energy security. The CPRS will encourage

development of new vehicle and fuel technologies. However, its impact on transport fuel demand over the next two decades is unclear. Areas requiring further consideration include the relationship between domestic and imported liquid fuel supplies, and the role that electricity, compressed natural gas and other alternative and renewable energy sources could have in the transport sector.

Further market reform initiatives and structural change can be expected in response to the decisions the government has made to establish the CPRS and to implement the requirement for 20 per cent of electricity generation to come from renewable sources. These demands can be expected to significantly alter historical investment patterns, which might in turn require adjustments to the operation of Australia's energy markets. An explicit price for carbon will substantially increase demand for energy sources that are not carbon intensive, leading to the development of new technologies and changes to the energy supply mix.

Aside from increasing energy supply, energy-efficiency measures are expected to play an increasingly significant role in reducing Australia's carbon emissions. Energy efficiency will come through changes to technology driven by price and regulatory measures and will lead to the replacement of our existing capital stock with more efficient technologies over time. A significant work program has commenced in recent years to improve demand management, however price signals are also expected to lead to improved capital utilisation and moderate the need for ever-increasing supply capacity to meet energy needs.

In considering these and related issues, the Energy White Paper may consider:

a) whether there are efficient and effective legislation and administrative frameworks to support the required investment

b) further long-term changes to domestic energy markets to improve their delivery of government objectives

c) forecast costs of energy across different technologies

d) measures to enhance energy efficiency and encourage demand side responses

e) the infrastructure required to meet Australia's future transport needs and those of national energy markets, and its investment outlook

f) whether there are the right market and economic signals for contestable and efficient energy markets.

5.5 Maximising the value of technology in the energy sector

Innovation, including in new technologies, can add depth to Australia's options to respond responsibly and cost-effectively to pressures on energy systems. Innovation has an important role in enhancing Australia's position as an internationally competitive supplier of energy and energy-intensive products, in contributing to reducing greenhouse gas emissions and in ensuring environmental sustainability. The range of technologies available will also determine the cost of structural change necessitated by climate change and other developments, and underpin Australia's ability to realise the opportunities that emerge as we move towards a lower carbon economy.

Given the scale of deployment of new technology likely to be required in the energy sector by 2030, policy actions will need to ensure that structural change occurs without amplifying the associated adjustment costs, and will need to allow Australia to take advantage of breakthrough technologies. Accelerating innovation and a technological response to climate change and other drivers are needed—the CPRS carbon price signal will reduce the cost gap between deploying the existing suite of energy technologies and the alternative lower emission technologies, but complementary policies may be required to foster timely development and commercialisation of more efficient, lower cost abatement technologies.

Given the scale and cost of large energy plant and commercial-scale demonstrations, and the need for multiple demonstrations in some cases, international cooperation and coordination to defray costs will be advantageous.

There is a mix of government and industry expenditure on bringing forward the deployment of energy technologies. Government contributions range from tax expenditures through to direct expenditure on science

or tied grants. These interventions are generally justified on the basis of assessments of market failure and the net public benefit. Market failure can vary at each level in the energy-sector innovation chain—research and development, demonstration and commercialisation. The cost of progressing to the next step in the innovation chain also tends to increase rapidly as the size of the investment scales up. By the time of a first fully integrated demonstration of the new energy technology, the gap between a commercial return on investment and the return on sales from the demonstration-sized plant can be substantial. The first several commercial-scale demonstrations might also lead to substantial cost reductions and increases in efficiency when the technology is subsequently deployed.

Investment in innovative capacity, unique comparative advantages and new technologies will create opportunities to generate new industries by supplying technical and scientific skills and new technology, both in Australia and internationally. Australia will benefit both from new jobs and income and from assisting other countries to grow using lower carbon technologies, thereby helping to address the global problem of climate change.

Further work to be incorporated into the Energy White Paper may include:

a) an assessment of options to overcome impediments to research, development and demonstration of energy technology, particularly to the take-up of renewable and alternative energy supply, energy efficiency and demand management technologies.

5.6 Our people: demographics, workforce, and Indigenous participation

Australia has a well-educated and skilled population. However, securing enough skilled and trained workers to overcome shortages affecting ongoing productivity growth is likely to remain a key national challenge in the light of competition for staff between industries, regions and projects within Australia, and in international markets.

Workforce redundancies arising from the current economic downturn demonstrate that the exporting sectors of the Australian economy are highly exposed when the global economy slows. However, over the whole economic cycle, global and national competition for professionals has the potential to increase the costs of delivering major energy projects in Australia. To prevent skills shortages developing within the energy sector at the peak of the investment cycle as a result of unforeseen demands or because of barriers to mobility, government, industry and communities need to encourage mobility and training. To address skills shortages in the short term, the energy sector also needs rapid access to skilled people from overseas. Many of these challenges are not unique to the energy sector.

One task for governments and the energy industry is to balance short-term and longer term pressures so that structural problems do not build up, resulting in avoidable resource pressures and consequent project cost inflation. Some potential bottlenecks to growth in the energy sector are in the area of demographics, and are related to regional development, differential state growth and workforce location. Governments and the energy industry need to cooperate on issues that affect the industry's competitiveness as an employer, such as the attractiveness of regional areas to workers and their families, and education and training to meet the industry's changing skills needs. Maintaining a comprehensive education and training system that meets the needs of the energy sector will be essential to ensure Australia's continued international competitiveness. Industry, governments and regional communities, in partnership with the education sector, must continue to address this challenge through sector-specific regional initiatives.

Many of Australia's significant energy resource projects are on the doorsteps of Indigenous communities. Those communities have the potential to participate more fully in energy and resources sector employment and business services. By making a commitment to Indigenous Australians, energy resource companies could help to close the gap between Indigenous people and the rest of the Australian community. This is an objective that should be pursued regardless of tightness or oversupply in the labour market.

Tensions over major planning decisions affecting the preservation of Indigenous heritage and over access to traditional lands for the development of energy resources need to be resolved. Effective engagement that ensures Indigenous views on land use issues are accommodated can reduce costs and increase project

certainty by protecting project developers from legal disputation, while forming a foundation for trust in the longer term.

Occupational health and safety and other regulation that protects employees in the workplace or protects the environment needs to keep pace with other developments in order to remain relevant and up to date.

Further work to be incorporated into the Energy White Paper may include:

a) community-based plans prepared by government, industry and Indigenous communities to support greater Indigenous participation in the energy sector

b) effective educational and training regimes to ensure an adequate and suitably skilled workforce.