

# AUSTRALIA

- *Australia will remain a major energy exporter in the APEC region, with coal and LNG exports reaching 301 Mtoe and 76 Mtoe respectively by 2030.*
- *Total primary energy demand is projected to grow at 1.6 percent annually, driven mainly by high demand for gas and oil from the rapid expansion of energy intensive industry, especially non-ferrous refining/smelting of aluminium, titanium and magnesium.*
- *Continued reliance on fossil fuels, especially coal in the electricity sector, will increase Australia's CO<sub>2</sub> emissions to twice that of the 1990 level by 2030.*
- *Investment of between US\$200-248 billion will be required to support the economy's energy demand growth.*

## RECENT ENERGY TRENDS AND ENERGY POLICY

Australia's primary energy consumption increased from 122 Mtoe in 2002 to 128 Mtoe in 2004, primarily from coal and gas spurred by growth in the industry and electricity sectors.

Australia is rich in indigenous energy resources and supplies nearly all of the domestic energy requirements apart from crude oil.

Energy exports are important to the economy, with Australia being the world's largest coal exporter and the third largest LNG exporter in the APEC region.<sup>1</sup> In 2005, out of total steaming and coking coal exports, 67 percent were exported to Japan (44 percent), Korea (11 percent), Chinese Taipei (8 percent), China and other ASEAN economies.

In 2005, on the back of high world energy and commodity prices, energy exports from Australia contributed 30 percent of total commodity exports of which export volumes of coal, LNG and uranium recorded historical highs. Coal exports were particularly important, earning AU\$17.1 billion and accounting for 58 percent of energy exports, followed by crude oil and petroleum products AU\$8.9 billion (30 percent), LNG AU\$3.2 billion (10 percent) and uranium AU\$475 million (2 percent).

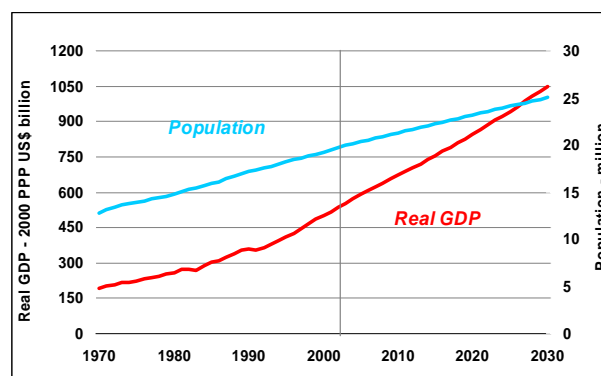
Australia enjoys a high level of energy security due mainly to the abundant indigenous energy resources. Notwithstanding Australia's current energy security position, the economy has undertaken a wide-ranging review of energy policies culminating in the release of the "Energy White Paper Securing Australia's Energy Future" in 2004. The Energy White Paper (EWP) provides the basis for Australia's energy policy as well as Australia's energy security

policy. The government's energy objectives consist of: 1) prosperity – that the value of energy resources is optimised; 2) security – that Australians have reliable access to competitively priced energy; and 3) sustainability – that environmental issues are well managed. In this context the future direction of energy resource use is to maximise the domestic utilisation of coal and to expand exports of natural gas in the form of LNG.

## ENERGY DEMAND DRIVERS

Australia's GDP is projected to grow at a rate of 2.4 percent per year over the outlook period compared with the growth of 3.1 percent per year over the last three decades, approximately doubling GDP by 2030. The structure of GDP is not expected to change significantly over the outlook period. The share of the services sector will remain the largest accounting for 70 percent of the total GDP. The share of the industrial value added to GDP will remain at around 30 percent as a result of the continued expansion of energy intensive industry and increased output of manufactured products.

Figure 1 GDP and Population



Source: Global Insights (2005)

<sup>1</sup> In 2005, Australia was the world's fifth largest LNG exporter, exporting 10.8 million tonnes from a capacity of 11.7 million tonnes.

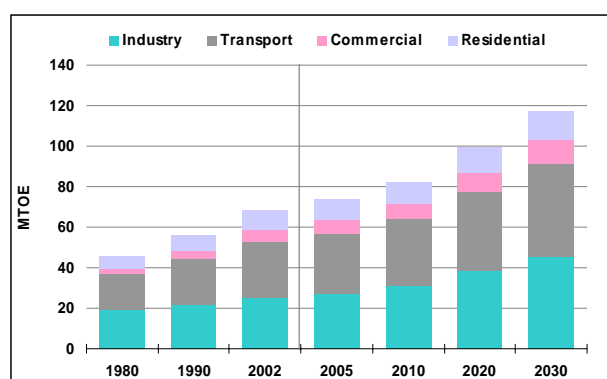
Population is projected to grow at 0.8 percent per year over the outlook period, falling slightly from the growth of 1.3 percent over the last 30 years. The population of Australia is expected to reach around 25 million in 2030, 20 percent higher than in 2002. Due to Australia's large geographical size and predominantly arid climate, the population has become largely concentrated in urban settlements on the eastern and south-eastern seaboard. In 2002, Australia's urbanisation level was 91 percent, and over the outlook period UN Habitat projects this level to increase to 96 percent in 2030.

## OUTLOOK

### FINAL ENERGY DEMAND

Final energy demand is expected to grow at 1.9 percent per year, the same rate of growth as the previous two decades.<sup>2</sup> The transport sector will account for the largest share at 40 percent, followed closely by industry (38 percent), residential (12 percent), and commercial (10 percent).

Figure 2 Final Energy Demand



Source: APERC Analysis (2006)

### Industry

Energy demand in the industrial sector is projected to grow at an average annual rate of 2.1 percent until 2030, faster than the average annual growth of 1.2 percent over the past two decades. The faster growth will be mainly driven by strong expansion of the energy-intensive refining and minerals processing industries. In particular, developments in the non-ferrous metal industries, including expansion of the aluminium industry and the establishment/emergence of magnesium and

titanium industries will contribute to the increase in demand.<sup>3, 4</sup>

Natural gas and electricity, the major energy sources in the aforementioned non-ferrous metal industries, are projected to maintain the largest share throughout the outlook period, and will grow at an average annual rate of 2.8 and 2.3 percent respectively. Combined, their energy demand will account for about two-thirds of industrial energy demand in 2030. By contrast, the share of oil and coal is projected to decrease from 22 percent and 10 percent to 18 percent and 8 percent respectively, while the share of renewable energy is projected to remain constant at around 9 percent over the outlook period. Biomass, which is largely utilised in cogeneration by the food, wood, and paper and pulp industries, will account for almost all of demand for renewables. Energy intensity<sup>5</sup> in the industrial sector is expected to decline at an average annual rate of 0.4 percent, much slower than the 1.7 percent decline over the past two decades.

### Transport

The road transport sub-sector dominates Australia's transportation sector accounting for more than 80 percent of total transport energy demand. Interstate freight and passenger transport rely heavily on road, as dispersed locations of agricultural, mining, production centres and residential suburbs are well connected by toll-free highway systems.<sup>6</sup> Passenger transport in urban cities is also dependent on road transport. Private vehicles offer the most convenient, reliable and fast means of transport for urban commuters, due to the lack of mass transit systems that connect city centres and suburbs.<sup>7</sup> As a result of this reliance, per capita energy consumption in the road transport sub-sector for Australia was 1.2 toe in 2002, taking the third highest position in the APEC region after the US and Canada.

Over the outlook period, road transport energy demand is projected to grow at an annual rate of 1.8

<sup>3</sup> ABARE (2005) assumes that alumina production will increase from 16.7 million tonnes in 2004 to 31.5 million tonnes in 2030, growing at an average rate of 2.5 percent per year.

<sup>4</sup> According to the "light metals action agenda", a magnesium industry will be established with production capacity of 800,000 tonnes per year to capture up to 50 percent of world demand growth for this metal over the next 20 years. Similarly, for titanium a 25,000 tonne per year industry will be established to capture a 25 percent share of the global market.

<sup>5</sup> The amount of energy needed to produce a dollar's worth of industrial sector's value added.

<sup>6</sup> A large proportion of rail freight is responsible for intrastate bulk commodity movements from the extraction or production sites to the seaport or processing centre.

<sup>7</sup> As urban sprawl has progressed in Australian cities.

<sup>2</sup> Fuel switching from coal to natural gas in the industrial sector is the main reason for the similar growth rate over the outlook period compared with the past.

percent, accounting for 74 percent of the total incremental increase in transport energy demand. By fuel type, the trend of growth for road transport shows substantial difference. As a result of the slower growth in population and continued energy efficiency improvements, gasoline demand for passenger vehicles is projected to grow at a moderate rate of 0.9 percent per year. In contrast, diesel demand for freight trucks is expected to grow annually at a constant rate of 2.0 percent, driven by the growth in agriculture and industrial activities at around 2.7 percent per year.

Energy demand in air transport is expected to grow at 2.8 percent per year, the fastest growing transport sub-sector. Further integration of Australia within global economic activities, and government efforts to reach bilateral/multilateral agreements on 'free skies' is expected to boost air travel. The volume of domestic air travel will also increase substantially as deregulation of the air industry continues to drive down airfares. As a result, jet kerosene demand for international air transport is projected to increase two-fold by 2030.

Rail is mainly used for bulk interstate freight/transport of commodities from extraction or production sources to the seaport or processing destinations. The extension of the trans-Australian railway from Alice Springs to Darwin, which was completed in 2003, is expected to result in increased use of rail for freight transport. For interstate passenger movement rail plays a minor role due to limited infrastructure. There was a plan to link Canberra and Sydney by TGV<sup>8</sup>, but this plan has not been realised due to financial constraints. As a result of the growth in freight transport, rail transport energy demand is expected to grow at 0.6 percent per year.

### Residential and Commercial

A gradual improvement in energy efficiency in the residential and commercial sectors over the outlook period will result in a slower annual growth rate for each energy source compared with the previous two decades. Australia's residential energy demand will grow at an annual rate of 1.4 percent, compared with 2.0 percent between 1980 and 2002. The energy mix is expected to broadly remain similar to that of 2002.<sup>9</sup> By energy source, natural gas is projected to grow at the fastest rate of 1.9 percent

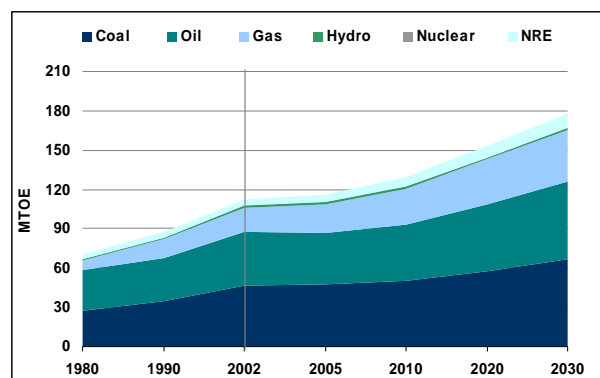
annually as it is expected to continue substituting kerosene. Electricity is expected to grow at the second fastest rate of 1.7 percent per year, followed by LPG for cooking and water heating at 1.4 percent per year. Fuel wood is projected to grow at an annual rate of 0.1 percent, as the main energy source for remote areas.

Energy demand in the commercial sector is mainly driven by the growth of value added for the services sector, and is expected to grow at 2.5 percent annually over the outlook period. Electricity accounts for more than 70 percent of total commercial energy demand, and this trend is expected to continue throughout the outlook period. Electricity demand is expected to grow at the fastest rate of 2.7 percent per year. Likewise, natural gas is expected to grow at 2.4 percent annually, as coal and diesel are replaced by natural gas as a fuel for boilers/on-site electricity generation in commercial buildings.

### PRIMARY ENERGY DEMAND

Australia's primary energy demand is projected to grow at an annual rate of 1.6 percent over the outlook period, slower than the previous two decades at 2.2 percent per year. Among the fossil fuels, natural gas is expected to grow at the fastest rate of 2.9 percent per year, followed by oil and coal at 1.3 and 1.2 percent respectively.

Figure 3 Primary Energy Demand



Source: APERC Analysis (2006)

Natural gas demand will be largely driven by the industrial and electricity sectors, accounting for approximately 81 percent of the total incremental growth. A gradual shift towards less carbon intensive electricity generation is behind this trend with 46 percent of incremental natural gas demand projected for use in electricity generation. The majority of natural gas is expected to be supplied domestically, but given the great distance between production centres in the west of the continent and demand centres in the south and south-east, pipeline

<sup>8</sup> TGV (*train à grande vitesse*, French for "high-speed train")

<sup>9</sup> In 2030, the share of electricity in total residential energy demand will account for 50 percent, followed by natural gas at 32 percent, combustible renewables and waste (mostly wood) at 15 percent, petroleum products at 3 percent, and solar and wind the remainder.

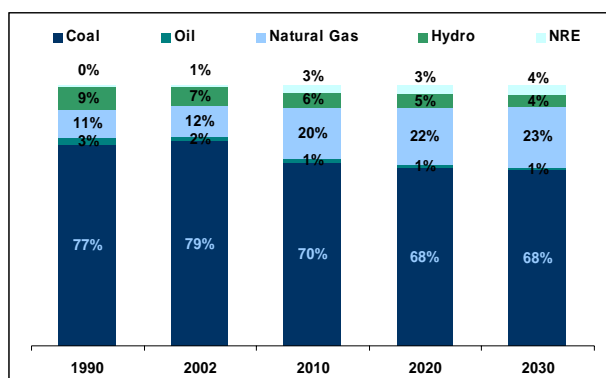
infrastructure will need to be developed. Another natural gas supply project that has been proposed is the importation of natural gas from Papua New Guinea, expected to begin in 2010.

Oil demand will be driven mainly by the transportation sector, accounting for 98 percent of the incremental growth. Given the dispersed geography of Australia, the large distances between major cities and between resource extraction locations and demand centres/export centres, transportation by road, air and rail will continue to be the major driver for oil demand over the outlook period. Australia supplies a significant volume of necessary oil requirements from domestic production; however, with a declining reserve to production ratio, oil import dependency is expected to reach 58 percent in 2030 from 21 percent in 2002.

**ELECTRICITY**

Electricity demand is projected to increase by 2.2 percent per year over the outlook period. Overall electricity generation from fossil fuels will remain dominant, with approximately 91 percent of the electricity generation mix from coal and natural gas in 2030. Coal will maintain the dominant share in the electricity generation mix; but will gradually decrease from 79 percent in 2002 to 68 percent in 2030. This decrease in coal will be offset by corresponding increase in the use of natural gas, which is projected to grow from 12 percent in 2002 to 23 percent in 2030. While electricity generation from renewables, especially biomass, wind, solar and others are projected to grow at the fastest rate of 9.2 percent per year, starting from a low base, the share in 2030 will still be low at 4 percent.

*Figure 4 Electricity Generation Mix*



Source: APERC Analysis (2006)

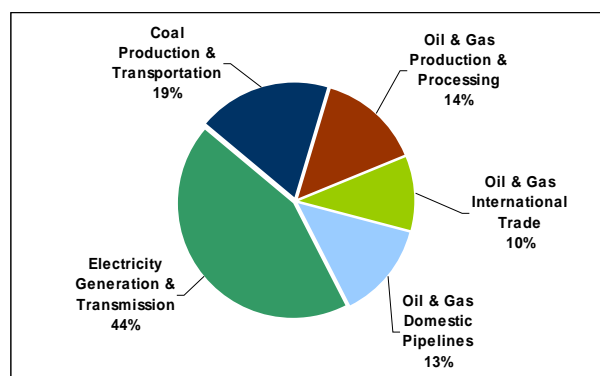
Installed capacity is projected to increase at 2.4 percent per year over the outlook period to reach 94 GW in 2030, almost double the 2002 capacity. The 45 GW of additional capacity to be constructed by 2030 will be roughly distributed between coal (19

GW) and natural gas (17 GW) with the remainder from renewables.

**INVESTMENT REQUIREMENTS**

Australia’s investment requirements over the outlook period are projected to reach between US\$200-248 billion by 2030. Investment in electricity generation and transmission will have the largest share of 44 percent followed by coal production and transportation (19 percent), oil and gas production and processing (14 percent), oil and gas domestic pipeline (13 percent), and oil and gas international trade (10 percent).

*Figure 5 Investment Requirements*

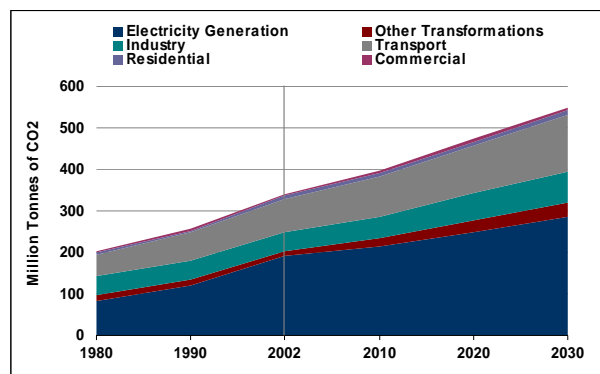


Source: APERC Analysis (2006)

**CO<sub>2</sub> EMISSIONS**

Over the outlook period, Australia’s total CO<sub>2</sub> emissions from the energy sector are projected to increase from 340 million tonnes of CO<sub>2</sub> in 2002 to 549 million tonnes of CO<sub>2</sub> in 2030. The majority of CO<sub>2</sub> emissions will come from the electricity sector at 52 percent, increasing to about 287 million tonnes of CO<sub>2</sub> by 2030.

*Figure 6 CO<sub>2</sub> Emissions by Sector*



Source: APERC Analysis (2006)



## MAJOR ISSUES

### REDUCTION OF CO<sub>2</sub> EMISSIONS

Australia, although a signatory to the UNFCCC, has not ratified the Kyoto Protocol and therefore does not have a commitment to reduce CO<sub>2</sub> emissions under this initiative. Domestically, to reduce CO<sub>2</sub> emissions, the Australian authorities have introduced a range of policy measures to support the development and use of renewable energy technologies. Among the measures which have been implemented are: 1) Mandatory Renewable Energy Target (MRET) scheme<sup>10</sup> and 2) New South Wales (NSW) Government's greenhouse gas emissions benchmark scheme.<sup>11</sup>

In addition, at the State level, there have been calls to reopen and re-evaluate the debate on commercial use of nuclear energy in Australia, in the face of concerns about CO<sub>2</sub> emissions in addition to the burgeoning demand for electricity within the economy. While these views have been echoed at some levels of Federal Government, the Commonwealth government's policy vis-à-vis the commercial operation of nuclear power plants within Australia is that uranium is not to be used as an energy source, but to be exclusively treated as an export commodity.

The challenge for Australia over the outlook period will be to find a method through which CO<sub>2</sub> emissions can be reduced in an efficient and economical way. To this end, Australia along with five other economies namely: the US, Japan, Korea, China and India have embarked on a "technology-based" approach to CO<sub>2</sub> reduction through the establishment of the Asia Pacific Partnership on Clean Development and Climate (AP6). AP6 was established to promote an enabling environment for the development, deployment, diffusion and transfer of existing technologies as well as emerging cost effective, cleaner technologies.

### DEVELOPMENT OF ENERGY INFRASTRUCTURE

Over the outlook period a significant amount of investment will be required for Australia to transport energy resources for domestic consumption from production centres to demand centres and to transport energy resources to ports for export. The challenge for Australia will be to make sure that the required infrastructural investment is undertaken in an efficient and timely manner.

In terms of natural gas, Australia's natural gas resources are remotely located in the northwest region, a great distance from major demand centres in the southern and eastern regions. Projected higher demand for natural gas in the electricity sector in the southern and eastern regions will precipitate the need for more investment in pipeline interconnection and networks to bring the gas across the economy. For example, Australia plans to link (1) Darwin with Moomba by a 2,200 km pipeline and (2) Papua New Guinea with Queensland through a 3,000 km pipeline from 2010. All the domestic oil and natural gas pipelines to be constructed in the economy over the outlook period are expected to cost between US\$23-33 billion.

In terms of coal, Australia has recently undertaken measures to significantly increase the capacity of coal transportation infrastructure, including expansion of the major rail and port facilities in New South Wales and Queensland.<sup>12</sup> It is imperative however, that all aspects of the coal supply chain, from loading at mining sites to the loading of vessels at port are expanded systematically and in parallel to minimise misalignment of infrastructure (resulting in bottlenecks and under utilisation of the overall capacity). To meet export capacity requirements over the outlook period an estimated US\$40-46 billion will need to be invested.

### POTENTIAL FOR LNG EXPORT

Australia is expected to become an important LNG supplier over the outlook period with the annual production of LNG projected to reach 20 million tonnes by 2010, 49 million tonnes in 2020 and 62 million tonnes in 2030.<sup>13</sup>

The LNG industry has the potential to attract up to US\$22 billion in new project investment over the outlook period, but is contingent on securing long-term supply contracts to underpin these investment requirements. However, due to the high LNG prices in the market, not many contracts have been signed in recent years. Once long-term sales and purchase agreements are signed, it is imperative that investment is undertaken in a timely manner such that Australia may remain a reliable and dominant LNG exporter within the Asia Pacific region.

<sup>10</sup> The scheme has already stimulated AU\$200 million of investment in new renewable energy projects, as well as the upgrading of existing electricity generators.

<sup>11</sup> State initiative that aims to reduce the per-capita greenhouse gas emissions associated with electricity consumption in NSW from the benchmark 8.65 tonnes CO<sub>2</sub>-eq in 2003 to 7.27 tonnes CO<sub>2</sub>-eq by 2007, continuing through to 2012.

<sup>12</sup> The various mining companies have developed strategies to bring an extra 40 million tonnes of coal production online by 2008 at a cost of AU\$2.6 billion to meet the anticipated growth in export demand through to 2015.

<sup>13</sup> Projection of LNG export capacity by APERC.

## IMPLICATIONS

Over the outlook period Australia is projected to remain the world's largest coal exporter and through massive expansion of export capacity is also poised to be a very important player in the Asia Pacific LNG market. To this end, it is imperative that regulation to facilitate investment is continuously streamlined and that this investment is undertaken in an efficient and timely manner such that Australia remains a reliable and dominant energy exporter within the Asia Pacific region.

In terms of decreasing CO<sub>2</sub> emissions and in general reducing the carbon intensity of the economy, to date many initiatives have been instigated at both the Federal and State/Territorial levels of government. However, to maximise the benefits of these initiatives to the advantage of the whole economy a truly holistic approach involving coordination/integration between each level of government is recommended.

## REFERENCES

- ABARE (2005a). *Australian Energy: national and state projections to 2029-30*.
- ABARE (2005b). *Infrastructure Issues in the Hunter Valley Coal Supply Chain*.
- ABC News (2005a). "Carr Calls for Nuclear Power Debate." 2 June, 2005. Website: [www.abc.net.au/news](http://www.abc.net.au/news).
- ABC News (2005b). "Outcry over Call for Nuclear Power Debate." 3 June, 2005. Website: [www.abc.net.au/news](http://www.abc.net.au/news).
- ABC News (2005c). "Renewed Call for Nuclear Power Debate." 8 June, 2005. Website: [www.abc.net.au/news](http://www.abc.net.au/news).
- Australian Government Senior Officials Group (2006). *Delivering Reliable Exports to the World: Coal Transport Infrastructure – report to government*. Website: [www.industry.gov.au](http://www.industry.gov.au).
- Australian Rail Track Corporation Ltd. (2006). *2006-2011 Hunter Valley Coal Network Capacity Improvement Strategy – Consultation Draft*, Website: [www.artc.com.au](http://www.artc.com.au).
- CSIRO (2002). *Energy and Transport Sector – Outlook to 2020*. Website: [www.dpr.csiro.au](http://www.dpr.csiro.au).
- Department of Industry, Tourism and Resources (2006). *Australian Liquefied Natural Gas (LNG) Industry*. Website: [www.industry.gov.au](http://www.industry.gov.au).

Light Metals Action Agenda (2001). *Australia Leading the Light Metals Age – Light Metals Action Agenda Strategic Leaders Group, Report to the Government*.