Australian Government
Department of Industry, Innovation and Science

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Australian Energy Update

2016

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Australian Energy Update 2016

October 2016

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Further information

From 27 September 2016, responsibility for the *Australian Energy Statistics* transferred to the Department of the Environment and Energy. For more information, please contact:

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Foreword

Energy supply and use in Australia continues to change. Energy production is increasingly export-oriented as our importance as a global energy supplier continues to grow. The type of energy we use and how we use this energy is also changing. Australians are using energy more productively, as new technologies are being adopted and as our economy changes in structure.

To help understand these and other changes, to plan for Australia's energy future and to make sound policy and investment decisions, we need accurate, comprehensive and readily-accessible energy data.

The *Australian Energy Statistics* is the authoritative and official source of energy statistics for Australia to support decision making, and help understand how our energy supply and use is changing. It is updated each year and consists of detailed historical energy consumption, production and trade statistics and balances. This edition contains the latest data for 2014–15. I encourage you to use the dataset, this report and guide that are available at www.industry.gov.au/oce.

The latest set of statistics shows that energy consumption in Australia rose in 2014–15 after two years of decline, supported by a rebound in coal use for electricity generation. Energy use in manufacturing continued to fall, and for the first time in more than a decade, so did energy use in mining. Coal and gas production and exports continued to grow, as did production of wind and solar energy.

From 27 September 2016, the energy statistics function, including responsibility for the *Australian Energy Statistics,* transferred to the Department of the Environment and Energy. Feedback can be provided to Australianenergystatistics@environment.gov.au.

Mark Cully
Chief Economist
Department of Industry, Innovation and Science
September 2016

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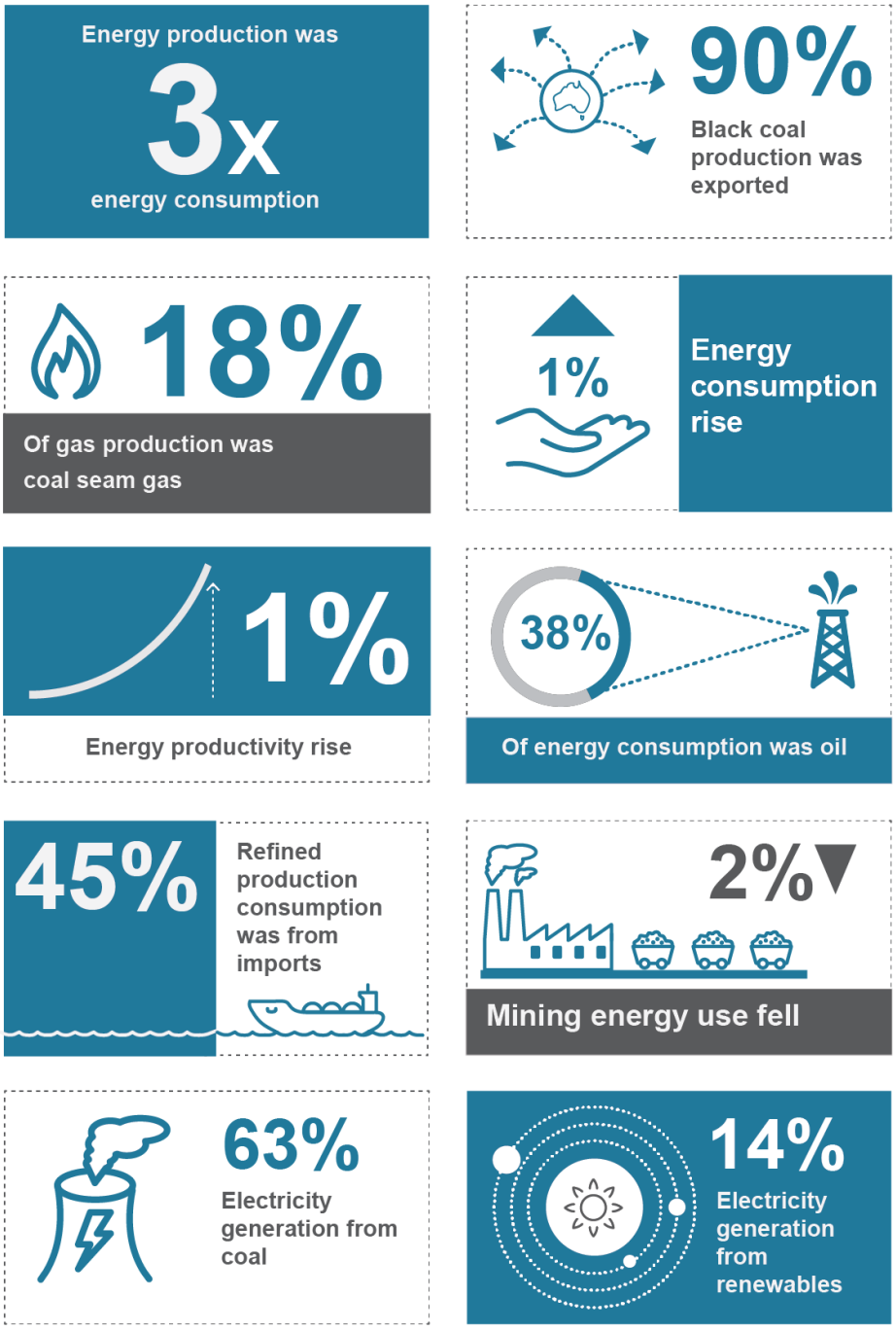
Abbreviations and acronyms

AES	Australian Energy Statistics
BREE	Bureau of Resources and Energy Economics (former)
GWh	Gigawatt hours
IEA	International Energy Agency
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
NEM	National electricity market
NGERS	National Greenhouse and Energy Reporting Scheme
NGL	Natural gas liquids
ORF	Other refinery feedstock
OCE	Office of the Chief Economist
PJ	Petajoules
PV	Photovoltaic

1. Executive summary

Australian Energy Statistics
2014–15



1.1 Energy consumption

- Australian energy consumption rose by 1 per cent in 2014–15 to around 5,920 petajoules, following two years of consecutive decline.
- Energy productivity (gross domestic product/energy consumption) rose by 1 per cent in 2014–15, and has increased by 28 per cent over the past 15 years.
- Most of the growth in energy use was for electricity generation, reflecting increased demand for electricity and a switch in the generation mix towards coal (which has a lower efficiency than renewables).
- Transport, which is the second largest energy use in Australia, continued to grow steadily by 1 per cent.
- For the first time in more than a decade, energy use in the mining sector fell in 2014–15. This decline in energy use occurred across the sector, despite general growth in output, and reflects cost cutting measures and adoption of less energy-intensive technologies.
- Energy use also fell in the manufacturing sector, mainly in non-ferrous metals, underpinned by some large industrial closures such as the Gove alumina refinery, Point Henry aluminium smelter and the Kurnell petroleum refinery.
- Final energy consumption, which excludes energy used in energy conversion activities such as electricity generation and petroleum refining, was flat in 2014–15.
- Oil remained the largest primary energy source in Australia, at 38 per cent in 2014–15, followed by coal (32 per cent) and natural gas (24 per cent). Renewables accounted for 6 per cent of Australia's energy mix.
- After five years of decline, coal use rose by 3 per cent in 2014–15, although consumption is still around 20 per cent lower than its peak in 2008–09.
- Use of gas and renewables grew by 1 and 2 per cent, respectively. Oil consumption fell by 1 per cent. The closure of domestic petroleum refining capacity outweighed increased end use for transport and electricity generation.

1.2 Energy production

- Energy production rose by 4 per cent in 2014–15 to 16,711 petajoules, supported by growth in coal and gas production.
- Black coal production rose by 4 per cent in 2014–15 to 12,288 petajoules, supported by new capacity for export markets and increased domestic demand. Brown coal production also rose by more than 8 per cent.
- Natural gas production rose by 5 per cent, underpinned by increased coal seam gas (CSG) production. CSG production accounted for 18 per cent of national gas production and nearly half of eastern market gas production in 2014–15.

- Crude oil, condensate and naturally occurring LPG production continued to fall by 6 per cent in 2014–15 as declining production at aging fields outweighed new supply.

1.3 Electricity generation

- Electricity generation in Australia rose by 2 per cent in 2014–15 to 252 terawatt hours (908 petajoules), following three years of decline. This reflects increased electricity demand in the National Electricity Market, and continued growth in off-grid use.
- Brown coal fired generation rose by 11 per cent in 2014–15, while black coal rose by 2 per cent, with coal accounting for 63 per cent of total generation. Despite this growth, Australia's reliance on coal is still lower at the beginning of the century, when its share was more than 80 per cent.
- Natural gas generation fell by 4 per cent in 2014–15, a result of capacity closures and higher gas prices. Gas accounted for 21 per cent of total electricity generation in 2014–15.
- Renewable generation fell by 7 per cent in 2014–15, comprising 14 per cent of total generation in Australia.
- Amost all of this fall was hydro, which fell by 27 per cent reflecting lower water availability. The contribution of hydro in 2014–15 was at its lowest since the mid-2000s drought.
- Wind and solar continued to grow, with wind now one-third of renewable generation in Australia and one-third of total generation in South Australia.

1.4 Energy trade

- Energy exports grew by 5 per cent in 2014–15 to 13,088 petajoules. Black coal and liquefied natural gas (LNG) exports rose as additional capacity came on line.
- Energy imports were relatively flat in 2014–15, at around 2,276 petajoules. A decline in crude oil imports was largely offset by a rise in imports of refined products, reflecting reduced domestic petroleum refining capacity from the closure of the Kurnell and Bulwer Island refineries.
- Australia remains a net energy exporter, with net exports equal to around two-thirds of domestic energy production. However, oil import reliance has increased, with 85 per cent of refinery feedstock and 45 per cent of refined production consumption now met from imports.

2. About the Australian Energy Statistics

The *Australian Energy Statistics* (AES) is the authoritative and official source of annual energy statistics for Australia. It provides information designed to increase the understanding of energy supply and use in Australia, to support decision making in government and industry, and to meet Australia's annual international energy reporting obligations. This official energy dataset also underpins the calculation of Australia's greenhouse gas emissions from energy supply and use by the Department of the Environment and Energy.

The AES provides detailed energy consumption, production and trade statistics and balances, by state and territory, by energy type, and by industry, in energy content and physical units. The most detailed sub-sectoral coverage is provided in the energy-intensive manufacturing sectors. Where possible, the data is compiled and presented using concepts and definitions intended to align the AES with the framework used by the International Energy Agency (IEA).

Key data sources include facility level reporting from the National Greenhouse and Energy Reporting Scheme (NGERS), the *Australian Petroleum Statistics* (APS), the *Resources and Energy* Quarterly, internal databases, estimates using statistical techniques, datasets and estimates from other Australian and state government agencies, and public company reporting. Some datasets from private subscription services and industry associations are also used to compare with these estimates and sources.

The AES has been published by the Department of Industry, Innovation and Science (2015 and 2016), the Bureau of Resources and Energy Economics (BREE) (2012 to 2014), the Australian Bureau of Agricultural and Resources Economics and Sciences (ABARES) (1989 to 2011), and various Australian government agencies, since the mid-1970s. From 27 September 2016, the energy statistics function, including responsibility for the AES, will transfer to the Department of the Environment and Energy.

The AES dataset is made available through a series of tables in Excel format at www.industry.gov.au/oce. A list of the AES tables available on the website is provided in Table 2.1.

The AES is accompanied by this report, the *Australian Energy Update*, which highlights recent trends in Australian energy consumption, production and trade.

The *Guide to the Australian Energy Statistics* is designed to assist users in better understanding the AES and to increase the transparency of the dataset. It contains information on the publication tables, definitions and concepts, data sources and methodology, conversion factors, confidentiality and historical revisions.

The AES reports in petajoules (PJ). 1 PJ = 1 x 10^{15} joules. One petajoule, or 278 gigawatt hours, is the heat energy content of about 43 000 tonnes of black coal or 29 million litres of petrol.

Table 2.1: 2016 *Australian Energy Statistics* tables

Table name	
Table A	Australian energy supply and consumption, energy units
Table B	Australian energy consumption indicators, by state, energy units
Table C	Australian total primary energy consumption, by state, by fuel, energy units
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Table Q	Australian consumption and production of natural gas, by state, physical units
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One petajoule (PJ) explained

The joule is the standard unit of energy in general scientific applications. One joule is the equivalent of one watt of power radiated or dissipated for one second.

One petajoule is 10^{15} joules (1 million billion) or 278 gigawatt hours.

19,000

The energy used by 19,000 homes in a year[1]

868,000

The electricity used by 868,000 refrigerators in a year[2]

2,354,000

The electricity used by 2,354,000 televisions in a year[3]

[1]The average home uses approximately 50 gigajoules of energy in 2014–15
[2]A typical 2.5 star fridge uses 320 kWh of electricity per year
[3]A 50 inch 5 star label television uses 320 kWh of electricity per year

3. Energy consumption

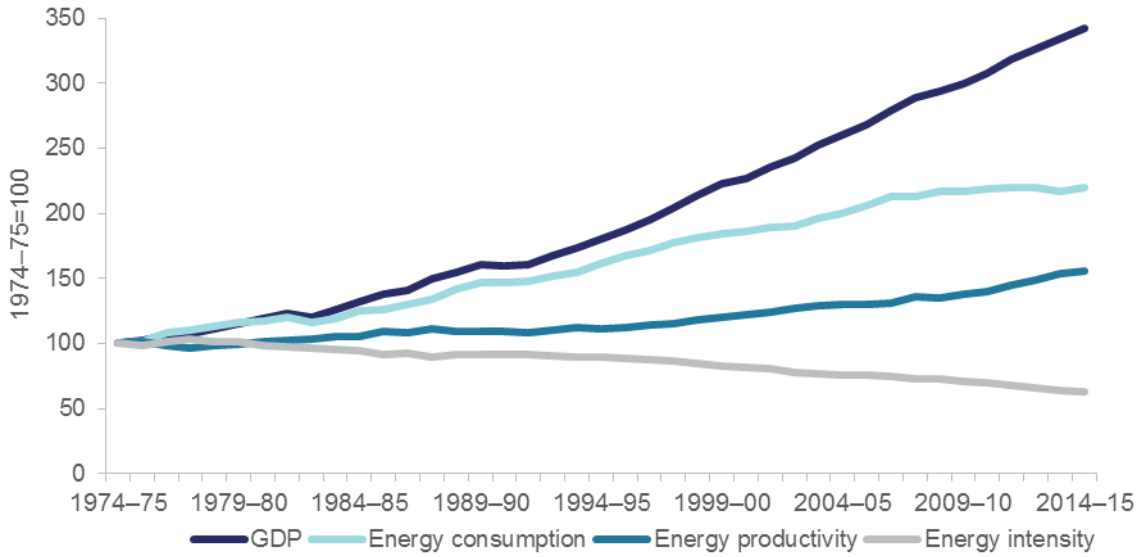
Energy consumption measures the total amount of energy used within the Australian economy. It is equal to indigenous production plus imports minus exports (and changes in stocks). It includes energy consumed in energy conversion activities, such as electricity generation and petroleum refining, but excludes derived fuels produced domestically to avoid double counting. It can be referred to as total net energy consumption and is also equal to total primary energy supply. Further detail is provided in Department of Industry, Innovation and Science (2016) *Guide to the Australian Energy Statistics*.

In 2014–15, Australian energy consumption rose by 1 per cent to 5,920 petajoules, following two years of decline. Energy consumption in 2014–15 is similar to levels of two years ago. The Australian economy grew by more than 2 per cent in 2014–15, while the population grew by 1 per cent.

Growth in energy consumption has generally remained below the rate of economic growth over the past three decades (Figure 3.1). This decline in the ratio of energy use to activity in the Australian economy is often referred to as a decline in energy intensity or a rise in energy productivity. It can mainly be attributed to a shift in the economy towards less energy-intensive sectors such as services and improvements in energy efficiency.

In 2014–15, energy productivity, as defined by the ratio of gross domestic product to energy consumption, rose by 1 per cent. Between 2000–01 and 2014–15, energy productivity rose by 28 per cent. Gross domestic product increased by 51 per cent over the same period, compared with growth in energy consumption of 18 per cent and growth in population of 23 per cent.

Figure 3.1: Australian energy intensity and energy productivity



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table B

3.1 By fuel type

Oil, including crude oil, liquefied petroleum gas (LPG) and refined products, accounted for the largest share of Australian energy consumption, at 38 per cent in 2014–15, similar to the previous year (Table 3.1). Oil consumption fell by 1 per cent in 2014–15, with the decline in crude consumption following closure of the Kurnell petroleum refinery in October 2014 and Bulwer Island refinery in May 2015 outweighing increased consumption of refined products for transport and electricity generation.

Table 3.1: Australian energy consumption, by fuel type

	2014–15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
Coal	1,907.8	32.2	3.0	–2.0
Oil	2,237.4	37.8	–0.9	1.4
Gas	1,431.0	24.2	1.3	4.1
Renewables	343.3	5.8	1.6	2.1
Total	**5,919.6**	**100.0**	**1.0**	**0.7**

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table C

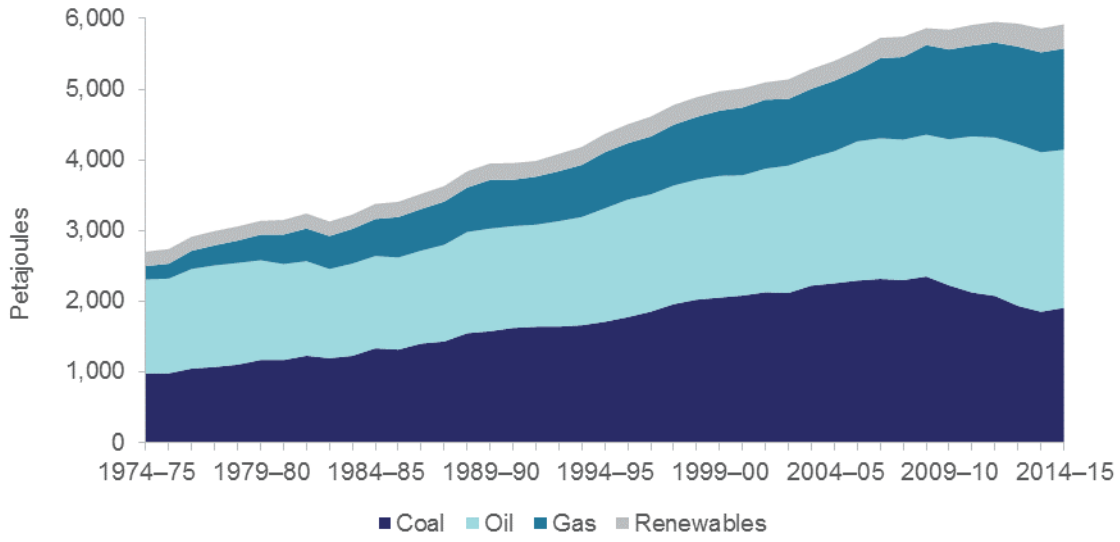
Coal remained the second largest primary fuel consumed in 2014–15, accounting for 32 per cent of energy consumption (Figure 3.2). After five years in a row of decline, coal consumption rose by 3 per cent in 2014–15, underpinned by increased black and brown coal use in the electricity generation. Despite this increase, Australia's coal consumption remains around 20 per cent lower in 2014–15 than its peak in 2008–09, when its share of the energy mix was more than 40 per cent.

Natural gas accounted for 24 per cent of energy consumption in 2014–15. Gas consumption rose by 1 per cent in that year, supported by increased gas-fired electricity generation in Queensland.

Renewable energy sources accounted for the remaining 6 per cent of total energy consumption in 2014–15, comprising mainly biomass, followed by hydro and wind energy. In 2014–15 renewable energy consumption rose by 2 per cent, with growth in bagasse, wind and solar outweighing the significant fall in hydro (Table 3.2).

Wind energy continued to be a significant driver of growth in renewables, increasing by 12 per cent in 2014–15 as additional capacity came online in several states. Solar PV and biogas use also grew strongly in 2014–15, by 23 and 17 per cent, respectively. Consumption of bagasse, mainly for heat in the food, beverage and tobacco sector, also rebounded in 2014–15, as the sugarcane harvest in Queensland recovered.

Figure 3.2: Australian energy consumption, by fuel type



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table C

Table 3.2: Australian renewable energy consumption, by fuel type

	2014-15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
Biomass	186.7	54.4	6.8	–1.2
- wood, wood waste	81.7	23.8	–2.1	–2.1
- bagasse	102.9	30.0	14.0	–0.6
- other waste	2.1	0.6	103.7	na
Biogas	19.1	5.6	17.0	9.9
Biofuels	11.4	3.3	–12.1	23.7
- ethanol	6.7	2.0	–22.7	na
- biodiesel	4.7	1.4	9.7	na
Hydro	48.4	14.1	–27.0	–1.9
Wind	41.3	12.0	11.8	23.5
Solar PV	21.5	6.3	22.9	59.3
Solar hot water	14.8	4.3	12.2	22.3
Total	**343.3**	**100.0**	**1.6**	**2.1**

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Tables D, F, O

3.2 By sector

The electricity supply, transport and manufacturing sectors accounted for three-quarters of Australian energy consumption in 2014–15 (Table 3.3).

The electricity supply sector accounted for 28 per cent of Australia's energy consumption in 2014–15. Energy consumption in this sector (including fuel inputs to electricity generation, own use and losses) rose by 5 per cent in that year, in response to increased electricity demand in the National Electricity Market (NEM) and off-grid, and an increase in the share of coal in the fuel mix. This is in contrast to the recent trend, with energy use for electricity supply generally in decline between 2008–09 and 2013–14 (Figure 3.3).

When measuring energy consumption, an increase in coal fired generation contributes more to primary energy consumption than an increase in renewable generation, because coal has a lower conversion efficiency.

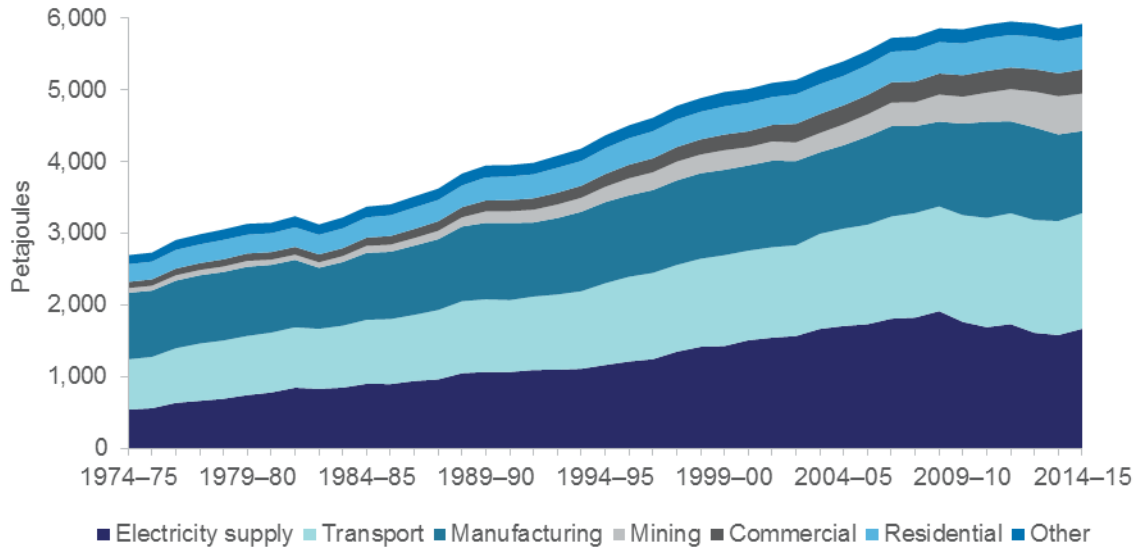
The transport sector accounted for 27 per cent of Australian energy consumption. Increased energy use in road transport resulted in a 2 per cent increase in the transport sector in 2014–15 (Table 3.4). Road transport accounted for nearly three-quarters of energy consumption in the sector. Air transport, which accounted for a further 19 per cent of consumption, fell slightly in 2014–15 in line with a fall in activity, particularly passenger transport.

Table 3.3: Australian energy consumption, by industry

	2014–15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
Transport	1,612.9	27.2	1.5	1.7
Electricity supply	1,666.9	28.2	5.5	–0.4
Manufacturing	1,147.1	19.4	–5.1	–0.8
Mining	520.7	8.8	–2.0	6.0
Residential	456.0	7.7	1.8	1.0
Commercial	336.2	5.7	4.7	2.4
Agriculture	104.4	1.8	4.8	0.8
Construction	27.2	0.5	2.0	0.4
Other	48.2	0.8	–10.6	–5.1
Total	**5,919.6**	**100.0**	**1.0**	**0.7**

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table E

Figure 3.3: Australian energy consumption, by sector



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table E

Table 3.4: Australian transport energy consumption, by subsector

	2014–15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
Road	1,179.2	73.1	1.9	1.3
Air	301.9	18.7	–0.4	4.2
Rail	56.4	3.5	1.9	5.2
Water	47.9	3.0	–9.5	–4.0
Other	27.4	1.7	11.8	0.0
Total	**1,612.9**	**100.0**	**1.5**	**1.7**

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table F

The manufacturing sector accounted for 19 per cent of energy consumption in 2014–15. Energy consumption in the manufacturing sector fell by 5 per cent in 2014–15, similar to the fall in the previous year. This was underpinned by a fall in energy use in non-ferrous metals, chemical, and petroleum refining (Table 3.5). Industrial closures, such as the Gove alumina refinery, the Point Henry aluminium smelter, and the Kurnell and Bulwer Island petroleum refineries, contributed to this decline in energy use. As mentioned earlier, there was a rise in energy use in the food, beverage and tobacco subsector following recovery in sugarcane harvest in Queensland.

Table 3.5: Australian manufacturing energy consumption, by subsector

	2014–15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
Non-ferrous metals	382.5	33.3	–8.1	–0.2
Chemicals	221.3	19.3	–7.0	2.1
Food, beverages and tobacco	164.9	14.4	6.9	4.8
Ferrous metals	117.6	10.3	–1.8	–4.0
Petroleum refining **a**	56.5	4.9	–25.0	–10.8
Wood, paper and printing	61.0	5.3	–0.1	–1.3
Cement	60.1	5.2	0.8	–0.2
Other	83.3	7.3	–2.0	–1.1
Total	**1,147.1**	**100.0**	**–5.1**	**–0.8**

Notes: a Net energy consumption in petroleum refining equals total energy consumption of 1,290.6 PJ minus derived fuel production of 1,234.1 PJ. The derived fuel production is netted off to avoid double counting of this energy in other sectors.

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table F

After more than a decade of strong growth, energy consumption in the mining sector fell in 2014–15, by 2 per cent (Table 3.6). This decline was observed across the sector, despite a general increase in output across a range of resources and energy commodities. A number of factors are likely to have contributed to the decline, including uptake of more efficient technologies, such as bigger trucks and loaders. It also reflects cost cutting measures following the decline in prices of many commodities in 2014–15. An example is postponing energy intensive activities such as overburden removal. Another factor is also likely to be mining less challenging ore grades than in the past when commodity prices were higher.

Table 3.6: Australian mining energy consumption, by subsector

	2014–15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
Oil and gas	215.1	41.3	–0.5	4.4
Coal	125.8	24.2	–4.1	5.5
Other mining	179.8	34.5	–2.2	8.7
Total	**520.7**	**100.0**	**–2.0**	**6.0**

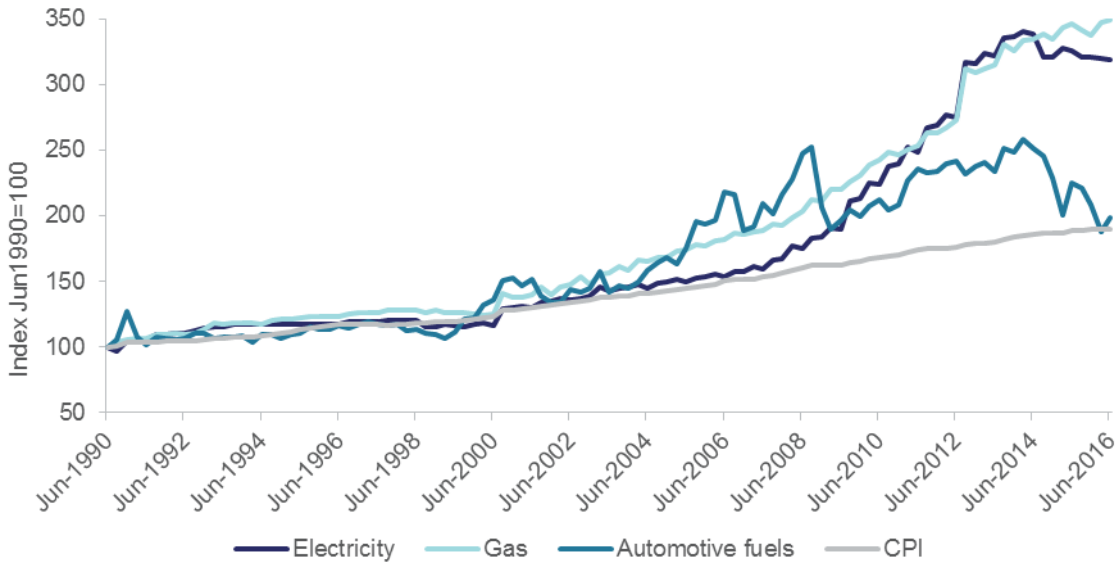
Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table F.

Energy consumption in the residential sector rose by 2 per cent in 2014–15, following a decline in the previous year. Consumption in the residential sector includes own use of electricity generated from rooftop solar photovoltaic (PV)

systems. In recent years, energy consumption has been flat or in decline in response to higher electricity prices and adoption of more energy efficient practices, appliances and housing.

The rebound in demand in 2014–15 is attributed to colder weather, which led to an increased demand for heating. The number of heating degree days, which is a measure of how much in degrees and for how long in days the outside air temperature was below a threshold, increased significantly across most states and territories. In New South Wales, population weighted heating degree days increased by 46 per cent in 2014–15, by 24 per cent in Victoria, and by 16 per cent in Queensland and South Australia. The fall in retail electricity prices in 2014–15 may also have contributed to the increased in residential electricity use in that year (Figure 3.4).

Figure 3.4: Household energy price index



Source: Australian Bureau of Statistics (2016) *Consumer Price Index, Australia, June 2016*, 6401.1

3.3 Final energy consumption

Total final energy consumption is the energy used by the final or end-use sectors, and is a subset of total energy consumption. It includes all energy consumed, except energy that is used to convert or transform primary energy into different forms of energy. For example, refinery feedstock that is used to produce petroleum products and fuels consumed in the generation of electricity are both excluded.

Final energy consumption in 2014–15 was flat (Table 3.7). The increase in energy use in electricity generation was offset by a fall in energy use in end use sectors such as mining and non-ferrous metals manufacturing.

Table 3.7: Australian total final energy consumption, by industry

	2014–15		*Average annual growth*
	PJ	share (per cent)	2014–15 (per cent)
Agriculture	104.4	2.6	4.8
Mining	520.7	12.8	–2.0
Manufacturing	987.3	24.2	–3.9
Construction	27.2	0.7	4.1
Transport	1,603.7	39.4	1.5
Commercial	336.2	8.2	4.7
Residential	456.0	11.2	1.8
Other	39.8	1.0	–12.3
Total	**4,075.4**	**100**	**–0.1**

Notes: Energy consumption in some sectors differs from Table 3.3 due to exclusion of energy used in conversion activities.

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table H

3.4 By region

New South Wales, Queensland and Victoria were the largest energy consumers in 2014–15, each accounting for nearly one-quarter of Australia's energy consumption (Table 3.8). Western Australia accounted for a further 18 per cent of energy consumption. In 2014–15, most growth in energy use was in Queensland, outweighing the decline in energy use in New South Wales, Tasmania, Northern Territory and South Australia.

Table 3.8: Australian energy consumption, by state and territory

	2014–15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
New South Wales a	1,475.0	24.9	–3.3	–0.5
Victoria	1,410.0	23.8	0.6	–0.2
Queensland	1,443.8	24.4	8.3	1.3
Western Australia	1,072.2	18.1	1.1	3.9
South Australia	326.4	5.5	–0.9	–0.8
Tasmania	107.2	1.8	–2.1	–0.4
Northern Territory	85.0	1.4	–14.7	1.7
Total	**5,919.6**	**100.0**	**1.0**	**0.7**

Notes: a Includes Australian Capital Territory

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table C

In Queensland, energy consumption increased by 8 per cent in 2014–15, mainly underpinned by an increase in coal and gas fired electricity generation. Queensland's growing LNG industry has driven higher demand for electricity. There was also an increase in energy use in food, beverages and tobacco with the recovery in sugarcane production, and in transport.

In Victoria, energy consumption increased slightly in 2014–15, with the rise in energy use for electricity generation largely offsetting the decline in the non-ferrous metals sector associated with the closure of Point Henry aluminium smelter in August 2014 and reduced production at the Portland aluminium smelter. Energy consumption in Western Australia rose by 1 per cent in 2014–15. An increase in energy use in electricity generation and non-ferrous metals more than offset the decline in energy use in mining and chemicals.

In New South Wales, falling energy use in the manufacturing sector contributed to a 3 per cent decline in total energy consumption, particularly in the petroleum refining sector after the closure of Kurnell in October 2014. There was also a decline in energy use in electricity generation. South Australian energy consumption fell marginally, with a slight fall in manufacturing and mining energy use outweighing a small increase in transport and in electricity supply.

Tasmanian energy consumption fell by 2 per cent in 2014–15, mainly in the electricity supply sector after the mothballing of the gas fired Tamar Valley power station. The significant fall in energy use in the Northern Territory is mainly attributed to the closure of the Gove alumina refinery in May 2014.

4. Energy production

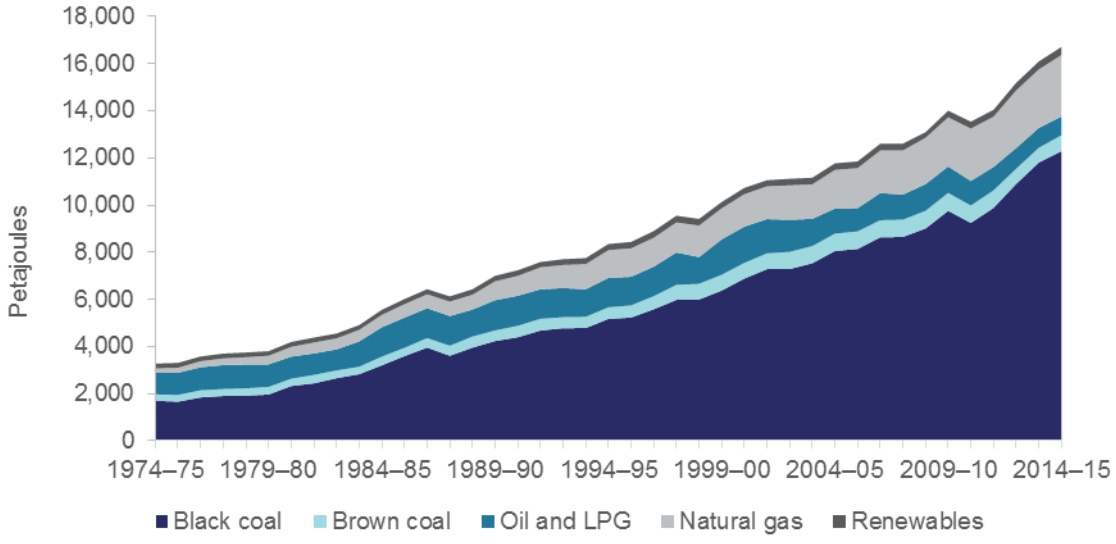
4.1 Primary production

Energy production is defined as the total amount of primary energy produced in the Australian economy, measured before consumption or transformation. Forms of renewable energy that produce electricity directly without a thermal component, such as wind, hydro and solar PV, are considered primary energy sources. Coal-fired electricity generation is considered secondary energy production, as the coal is already accounted for when mined.

Domestic production of primary energy increased by 4 per cent in 2014–15, to reach 16,711 petajoules (Figure 4.1). This is consistent with trends in energy production over the past decade. Production is becoming increasingly export-oriented. Australia is a net exporter of energy, including coal and natural gas, with net exports equal to around two-thirds of production (Figure 4.2).

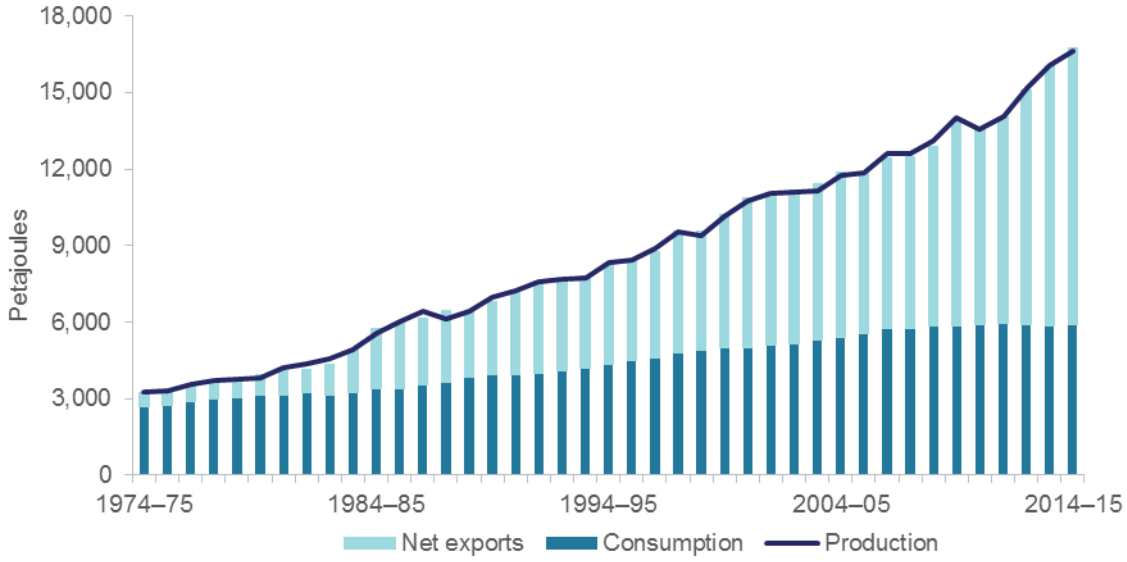
Black coal production increased by 4 per cent in 2014–15, to reach 12,288 petajoules (447 million tonnes). Growth in production was slower than in 2013–14, with the fall in world coal prices in 2014–15 leading several major operators, including Peabody and Glencore, to reduce output or suspend operations in order to minimise losses. However, the impact of these decisions was offset by new capacity, including the expansion of the Drake Coal and Middlemount mines in Queensland and the Boggabri project in New South Wales.

Figure 4.1: Australian energy production, by fuel type



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table J

Figure 4.2: Australian energy balance



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table J

After two years of decline, brown coal production increased in 2014–15, by 8 per cent to 678 petajoules (65 million tonnes). However, the level is still around 11 per cent lower than peak production in 2009–10. This reflects the rebound in brown coal fired electricity generation at co-located power stations. Increased demand for brown coal fired electricity, and subsequently brown coal production, reflects a significant fall in hydro generation, mainly as a result of lower water availability. It also reflects mine capacity coming back online following disruptions. The resurgence in brown coal production also coincided with the repeal of the carbon price on 1 July 2014. As an emission intensive fuel type, the repeal of the carbon price improved the cost of coal relative to other fuels.

Table 4.1: Australian energy production, by fuel type

	2014–15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
Black coal	12,287.9	73.5	4.1	4.7
Brown coal	678.4	4.1	8.5	–1.0
Natural gas	2,607.1	15.6	5.2	4.9
Oil and NGL	704.9	4.2	–5.4	–2.1
LPG	89.7	0.5	–10.7	–3.8
Renewables	343.3	2.1	1.6	2.1
Total	**16,711.2**	**100.0**	**3.8**	**3.9**

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table J

Natural gas production rose by 5 per cent in 2014–15 to 2,607 petajoules (66 billion cubic metres). Western Australia remained Australia's largest producer of natural gas, producing nearly two-thirds of total gas production in 2014–15. Queensland production grew 45 per cent to become Australia's second largest producer, overtaking Victoria, where production fell by 11 per cent.

Production of coal seam gas increased by 50 per cent in 2014–15, to reach 462 petajoules (12 billion cubic metres), as new wells were drilled in Queensland to support the start of LNG exports from Gladstone. Coal seam gas accounted for 18 per cent of Australian gas production on an energy content basis, and nearly half of east coast gas production.

Australia produced 705 petajoules (19 billion litres) of oil and natural gas liquids in 2014–15, a decline of 5 per cent relative to the previous year. The fall in output was largely the result of continued declines in production at mature fields in the eastern states.

Renewable energy production increased by 2 per cent in 2014–15 to reach 343 petajoules, with a fall in hydro and fuelwood production outweighing continued growth in wind and solar PV. Renewable energy accounted for 2 per cent of total energy production in 2014–15, similar to its share in recent years.

Box 4.1: Uranium production

From 2016, uranium will no longer be included in total Australian energy production in the *Australian Energy Statistics*. This is to ensure Australia's energy production statistics are comparable internationally. For those interested in uranium production and export statistics, a separate Excel table has been produced in the *Australian Energy Statistics* (Table S).

Australian uranium production increased by 9 per cent in 2014–15 to 2,592 petajoules (6,496 tonnes). The growth in production was underpinned by new production from the Four Mile mine in South Australia, and recommencement of operations at the Ranger mine in the Northern Territory, which suspended production in December 2013.

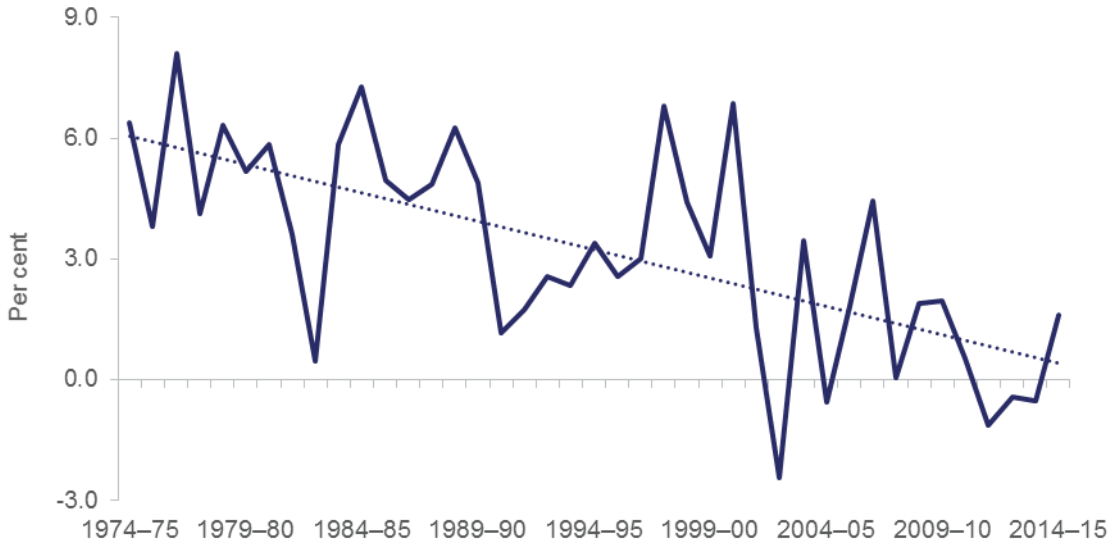
Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table S

4.2 Electricity generation

In 2014–15 total electricity generation in Australia increased by nearly 2 per cent, after three consecutive years of decline (Figure 4.3). Total electricity generation was 252 terawatt hours (908 petajoules) in 2014–15, still below the peak of 254 terawatt hours in 2010–11. The return to growth reflected increased demand for electricity, including in the commercial and residential sectors.

This figure captures all electricity generation in Australia. In addition to power plants, it includes rooftop solar PV generation, generation by industrial facilities such as in mining and manufacturing, and off-grid generation.

Figure 4.3: Annual growth in Australian electricity generation



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table O and L

Electricity generation increased in 2014–15 in Queensland (by 13 per cent), Victoria (by 7 per cent) and Western Australia (by 2 per cent), but declined in all other states and territories. Generation in the National Electricity Market (NEM) states increased by 2 per cent overall in 2014–15. This growth is largely attributed to increasing demand for electricity due to the start-up of LNG projects in Queensland, as well as increased residential and commercial demand, mainly for heating.

It also reflects continued expansion in off-grid generation, particularly in the mining sector in Western Australia. Off-grid electricity generation accounted for an estimated 17 per cent of total generation in 2014–15.

Coal remained the major fuel source for electricity generation in 2014–15, with its share in the fuel mix increasing to 63 percent, up from 61 per cent in 2013–14 (Table 4.2). However, this is still well below its share of more than 80 per cent at the beginning of the century (Figure 4.4). Actual levels of coal-fired generation are similar to levels observed in 1997–98.

Coal-fired generation increased in Victoria, South Australia and Queensland in 2014–15, with brown coal-fired generation rising by 11 percent, and black coal by 2 per cent. This increase followed seven consecutive years of decline in black coal-fired generation and five in brown. The switch back to coal reflects reduced water availability for hydro generation, and higher prices for gas. It also coincides with the removal of the carbon price.

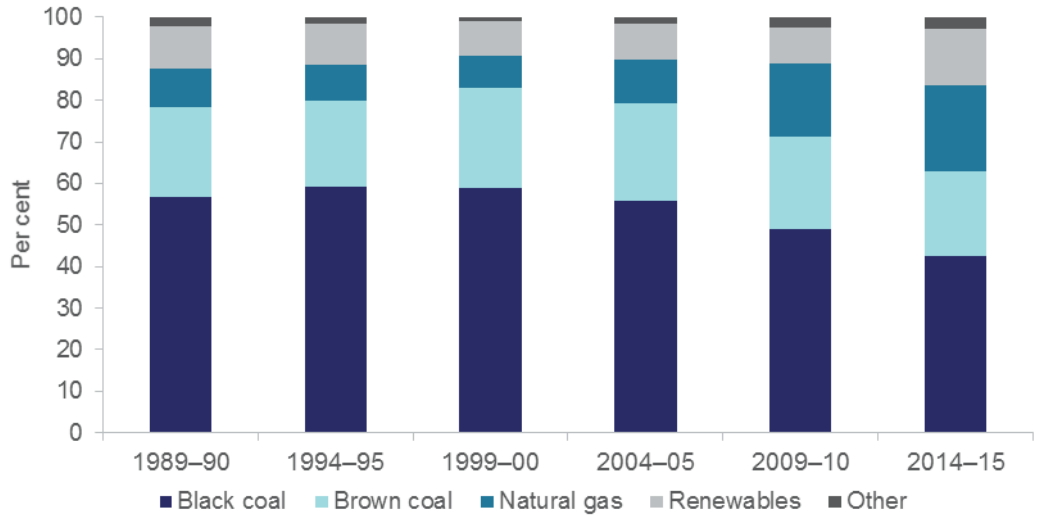
Natural gas-fired generation decreased by 4 per cent in 2014–15, to account for 21 per cent of Australia's electricity generation. Generation fell in all states except Queensland, where there was an increase of 18 per cent. This general decline reflects the closure of some gas-fired power stations, such as Tamar Valley in Tasmania, and higher gas prices.

Table 4.2: Australian electricity generation, by fuel type

	2014–15		*Average annual growth*	
	GWh	share (per cent)	2014–15 (per cent)	10 years (per cent)
Fossil fuels	217,871	86.3	3.1	0.4
Black coal	107,639	42.7	1.8	–2.1
Brown coal	50,970	20.2	10.6	–0.8
Gas	52,463	20.8	–3.6	9.7
Oil	6,799	2.7	35.6	9.3
Renewables	34,488	13.7	–6.9	5.3
Hydro	13,445	5.3	–27.0	–1.9
Wind	11,467	4.5	11.8	23.5
Bioenergy	3,608	1.4	11.4	–1.0
Solar PV	5,968	2.4	22.9	59.3
Geothermal	1	0.0	27.3	2.7
Total	**252,359**	**100.0**	**1.6**	**0.9**

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table O

Figure 4.4: Australian electricity generation fuel mix



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table O

Oil-fired generation increased in 2014–15, to a 3 per cent share of Australia's electricity generation. This increase occurred largely in Western Australia where it may be attributed to increased demand for power in remote mining regions.

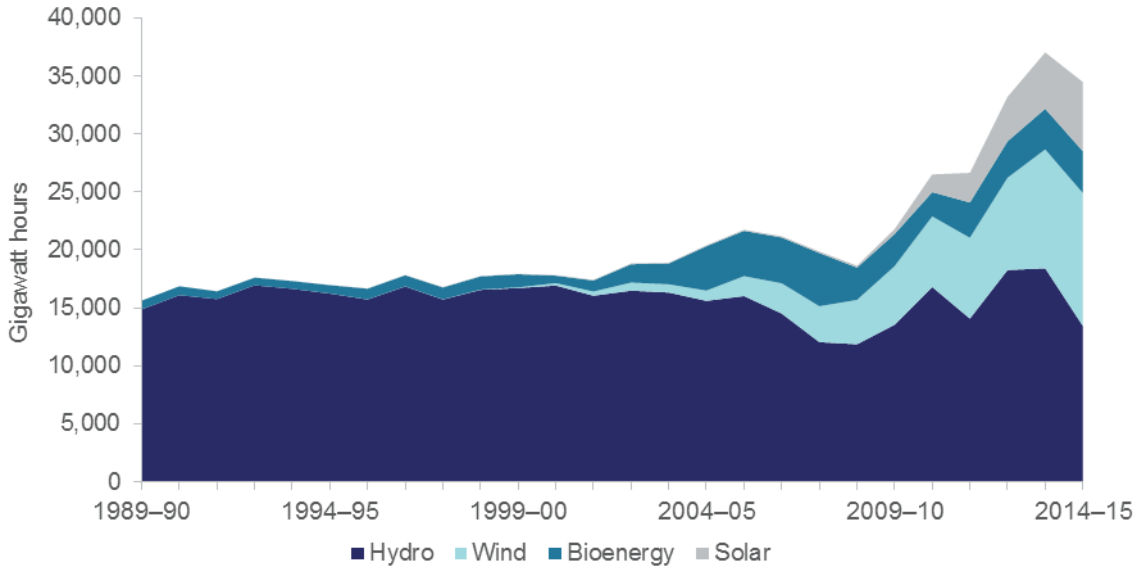
Renewable energy accounted for 14 per cent in Australia's electricity generation in 2014–15. Renewables generation declined by 7 per cent in 2014–15, driven by hydro generation, which declined by 27 per cent. This is mainly attributable to lower water levels in hydro dams, particularly in Tasmania.

Nonetheless, hydro continues to be the largest contributor to renewable generation, with a share of 39 per cent in 2014–15 (Figure 4.5). This is down from 55 percent of renewable generation in 2012–13 and 86 per cent in 2003–04. Hydro's share of total electricity generation in 2014–15 was the lowest since the drought of the mid-2000s.

Wind was a close second behind hydro in its contribution to renewable generation in 2014–15, contributing 33 percent of renewable electricity and 5 per cent of total electricity generation in Australia. Wind generation rose by 12 per cent in 2014–15. Wind generation continues to be particularly prevalent in South Australia, accounting for one-third of the total fuel mix in that state in 2014–15.

Solar generation also continued to grow strongly in 2014–15, by 23 per cent, and accounted for 2 per cent of total electricity generation in Australia. The largest growth occurred in large-scale solar installations that have come online in New South Wales, including the Royalla Solar Farm. However, this growth was from a small base, and rooftop solar PV installations continue to make up the majority of total solar generation in Australia.

Figure 4.5: Australian electricity generation from renewable sources



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table O

5. Energy trade

5.1 Exports

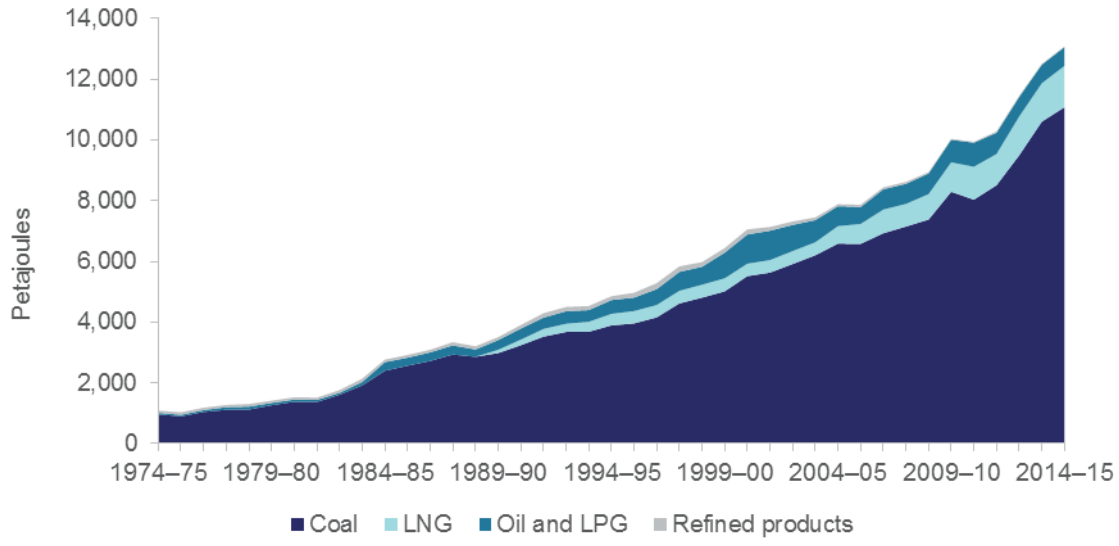
Australia's energy exports rose by nearly 5 per cent in 2014–15 to reach 13,088 petajoules, supported by an increase in coal and LNG exports (Table 5.1; Figure 5.1). The aggregate energy export trends reported in the 2016 edition differ from previous editions with the exclusion of uranium from the tables and figures.

Table 5.1: Australian energy exports, by fuel type

	2014–15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
Black coal	11,062.9	84.5	4.6	5.9
Coal by-products	18.5	0.1	–32.5	na
LNG	1,362.6	10.4	7.7	8.5
Crude oil	560.6	4.3	2.3	1.7
LPG	57.0	0.4	–14.1	–3.1
Refined products	26.0	0.2	5.6	–11.3
Total	**13,087.6**	**100.0**	**4.6**	**5.8**

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table J

Figure 5.1: Australian energy exports, by fuel type



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table J

Exports of black coal increased by nearly 5 per cent in 2014–15 in energy content terms, to reach 11,063 petajoules (392 million tonnes), supported by additional production from new projects and increased output from existing

mines. While still robust, growth was lower than 2014–15, particularly in metallurgical coal exports, mainly as a result of weaker growth in Chinese steal production. On average, coal exports have grown by 6 per cent a year over the past decade, with strong global demand, particularly from Asia, stimulating investment in a number of expansions and new mine and infrastructure capacity.

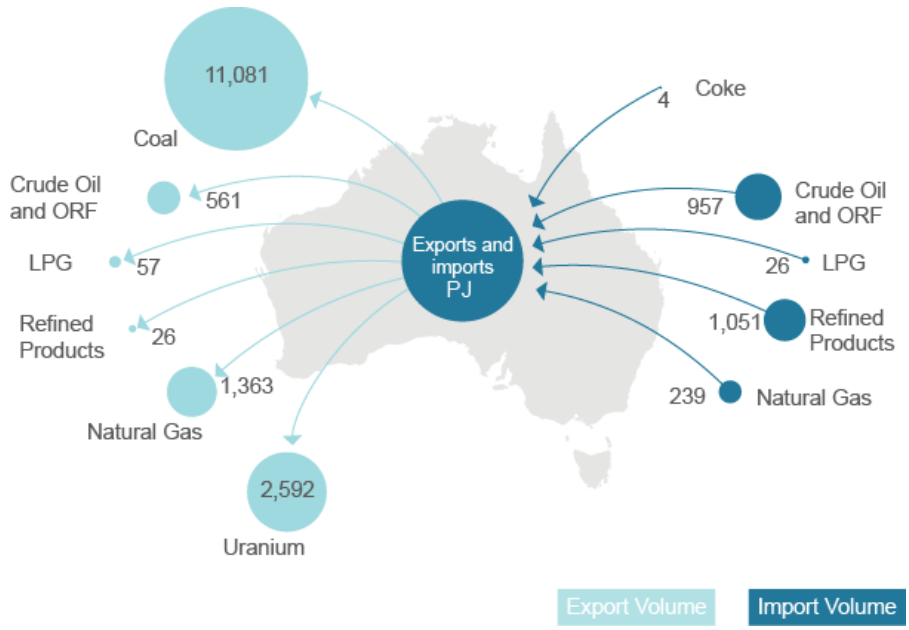
LNG exports also increased by 8 per cent in 2014–15, to 1,363 petajoules (25 million tonnes), as new export capacity on the east coast commenced. Exports of LNG have increased by 9 per cent a year over the past decade, supported by two additional LNG trains at the North West Shelf (in 2004 and 2008), the start-up of Darwin LNG in 2006, Pluto LNG in 2012, and QCLNG in late 2014.

Crude oil exports rose by 2 per cent in 2014–15 to 561 petajoules (15 billion litres), reflecting increased offshore production, including from the Coniston and Balnaves projects.

5.2 Imports

Australia's energy imports were relatively flat in 2014–15, at 2,276 petajoules, although as with the previous year, this masked large movements in individual fuels. Refined products and crude oil remained Australia's largest energy imports. Natural gas from the Joint Petroleum Development Area in the Timor Sea, which is liquefied at Darwin before being re-exported, was the third largest energy import (Figure 5.2).

Figure 5.2: Australian energy trade, 2014–15



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table J

Imports of crude oil declined by 13 per cent in 2014–15, to 957 petajoules (25 billion litres) in line with the closure of domestic refining capacity in New South Wales at Kurnell and Bulwer Island (Table 5.2).

Table 5.2: Australian energy imports, by fuel type

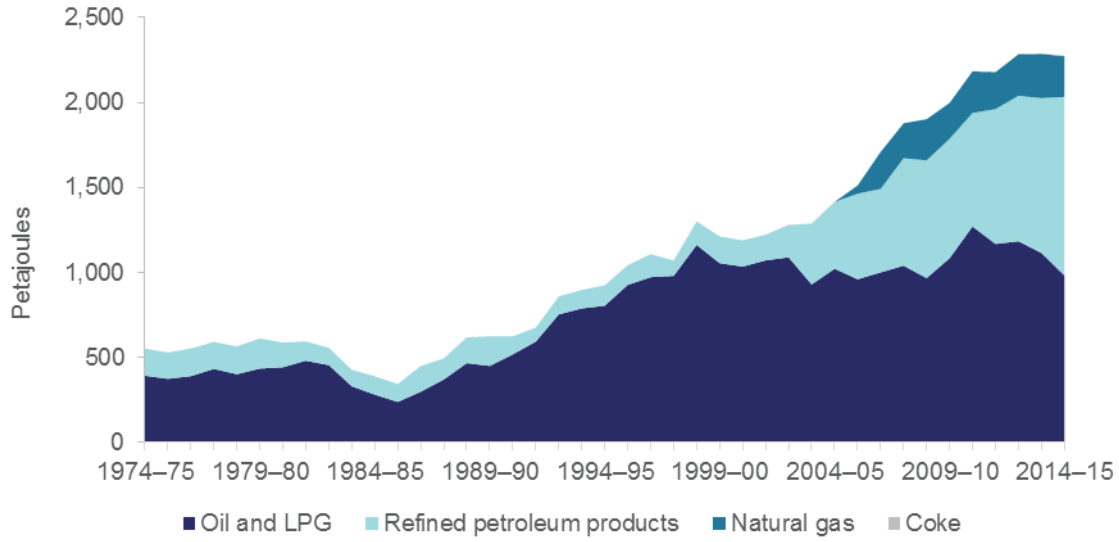
	2014–15		*Average annual growth*	
	PJ	share (per cent)	2014–15 (per cent)	10 years (per cent)
Crude oil	956.7	42.0	–12.7	0.1
LPG	25.9	1.1	31.4	5.4
Refined products	1,051.0	46.2	15.4	8.5
Natural gas	239.0	10.5	–8.1	19.4
Coke	3.5	0.2	43.8	9.8
Total	**2,276.2**	**100.0**	**–0.6**	**4.6**

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table J

Australia imports a relatively large proportion of its refinery feedstocks, with most of Australia's oil production now occurring off the north-west coast of Australia. In addition, domestically produced grades of crude oil are generally not as well suited for use by local refineries as those sourced from other countries. Imports accounted for 85 per cent of total refinery input in 2014–15.

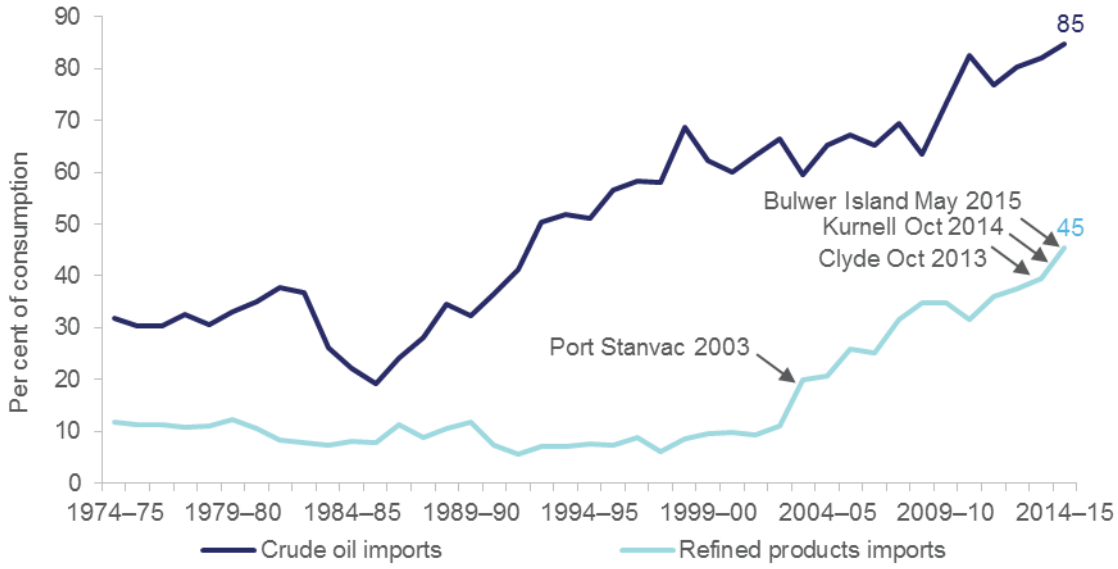
The decline in domestic refining capacity also contributed to an increase in imports of refined products. Refined product imports, excluding LPG, grew by 15 per cent in 2014–15, reaching 1,051 petajoules (28 billion litres) (Figure 5.3). This continues the longer-term trend towards imported refined products, which have grown by an average of 9 per cent a year over the last decade and now account for around 45 per cent of total refined product consumption (Figure 5.4).

Figure 5.3: Australian energy imports, by fuel type



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Table J

Figure 5.4: Share of imports in total consumption of crude and refined products



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*, Tables J and D

6. References

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Department of Industry, Innovation and Science (2016) *Guide to the Australian Energy Statistics*, Canberra, September.