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**Department of Industry, Science,
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Australian Energy Update 2021

September 2021



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Australian Energy Statistics

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The Department acknowledges the traditional owners of country throughout Australia and their continuing connection to land, sea and community. We pay our respects to them and their cultures and to their elders both past and present.

Foreword

The way we supply and use energy in Australia continues to change. This includes changes in the type of energy we use, how we use it and where it comes from. Change also comes as new technologies are adopted, as our economy changes, and as awareness of our energy use and its economic and environmental cost grows.

We need timely, accurate, comprehensive, comparable and readily-accessible energy statistics to help understand these and other changes. We need this understanding to plan for Australia's energy future, and to make sound policy and investment decisions.

The *Australian Energy Statistics* is the authoritative and official source of energy statistics for Australia to support decision making and international reporting, and to 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. It includes all types of energy and all parts of the economy.

This edition contains data to financial year 2019–20 for Australian energy consumption, production and trade, and calendar year 2020 for electricity generation. This report, the full dataset, and a guide are available online. Release of the 2022 edition, containing data for financial year 2020–21, is expected on September 2, 2022. An intervening release of updated electricity generation data is expected in the first half of 2022.

The COVID-19 pandemic had a significant effect on Australia's energy supply and use in the final quarter of 2019–20. Transport energy use fell for the first time in nearly twenty years; oil imports and refinery production fell; and there was switching away from commercial into residential energy use as people stayed and worked from home. Other longer term trends continued relatively unaffected, with strong growth in LNG exports and associated energy use; strong growth in wind and solar generation; and a further decline in coal consumption.

Feedback regarding the Australian Energy Statistics can be provided to energy.statistics@industry.gov.au.

Energy Statistics and Analysis Section
Analysis and Insights Division
Department of Industry, Science, Energy and Resources
September 2021

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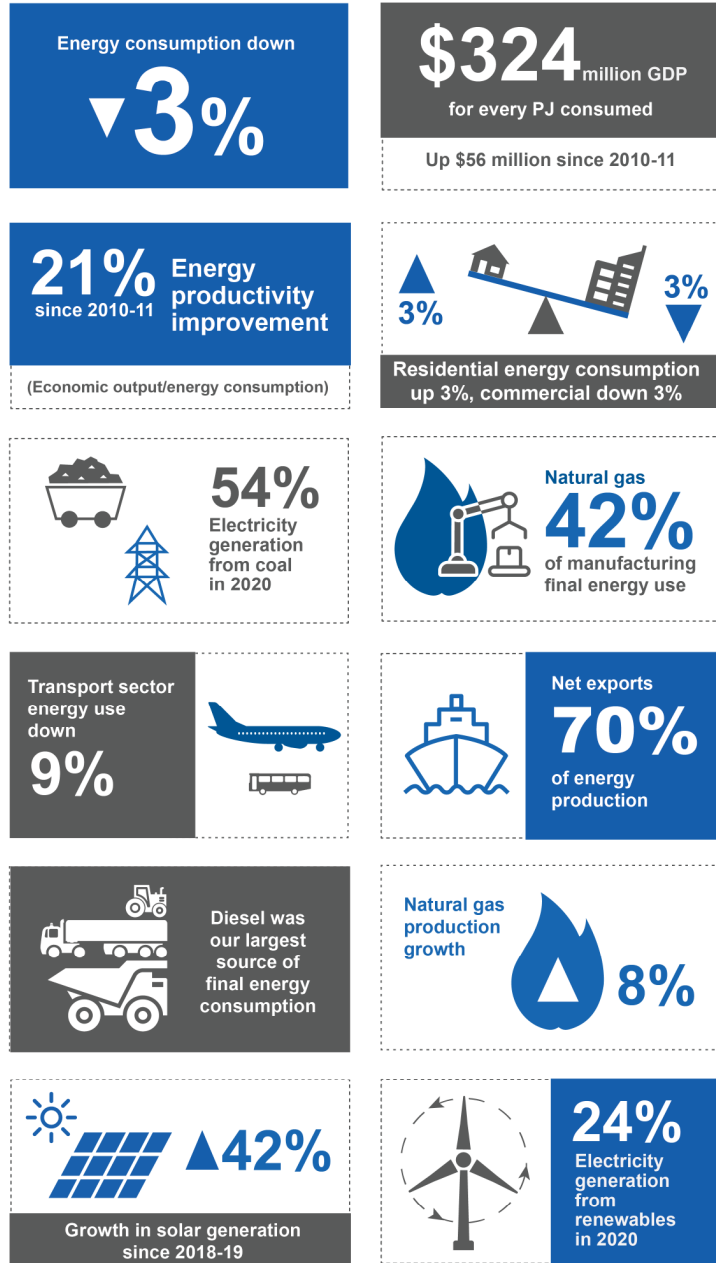
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Abbreviations

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
AEMO	Australian Energy Market Operator
AES	Australian Energy Statistics
APS	Australian Petroleum Statistics
BITRE	Bureau of Infrastructure and Transport Research Economics
BREE	Bureau of Resources and Energy Economics (former)
COVID-19	Coronavirus disease 2019
CSG	Coal seam gas
DISER	Department of Industry, Science, Energy and Resources
GJ	Gigajoule (10^9 joules)
GWh	Gigawatt hours
GDP	Gross domestic product
IEA	International Energy Agency
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
NGERS	National Greenhouse and Energy Reporting Scheme
NGL	Natural gas liquids
ORF	Other refinery feedstock
OCE	Office of the Chief Economist
PJ	Petajoule (10^{15} joules)
PV	Photovoltaic

Executive summary

Australian Energy Statistics In 2019–2020



- Australia's energy consumption fell in 2019–20 due to COVID-19
- Transport energy use fell for first time in nearly twenty years
- Gas, wind and solar use continues to grow strongly
- Coal still dominates the electricity mix
- LNG exports continued to drive growth in domestic gas use

Energy consumption

- The Australian economy contracted by 0.3 per cent in 2019–20 to \$1.9 trillion. Population grew by 1.3 per cent to reach 25.7 million people.
- Australia's energy consumption fell by 2.9 per cent in 2019–20 to 6,014 petajoules. This compares with average growth of 0.7 per cent a year over the previous ten years to 2018–19.
- The drop in energy consumption in 2019–20 was 182 petajoules: the same amount of energy from filling a 55-litre tank of petrol 97 million times.
- Energy productivity (gross domestic product (GDP) divided by energy consumption) improved by 2.7 per cent in 2019–20 and by 21 per cent over the past ten years. Australia now creates \$324 million in GDP for every petajoule of energy consumed, about \$56 million more than a decade ago.
- The largest reduction in energy use in 2019–20 occurred in the transport sector, which fell by 9 per cent, due to COVID-19 restrictions on aviation and passenger road transport in the last quarter of the period.
- Transport remained the largest user of energy despite the reduced activity, constituting 27 per cent of all energy use.
- Energy use also fell in the commercial sector due to COVID-19 impacts, in agriculture because of the drought, and in manufacturing (mostly for sugar and petroleum refining).
- Mining energy use increased in 2019–20, supported by LNG and iron ore export growth, as did residential energy use with more people working and staying at home.
- Oil consumption fell by 7 per cent in 2019–20 as a result of lower transport use and lower crude consumption by refineries. Oil remained Australia's largest source of primary energy consumption, at 37 per cent of the total.
- The share of natural gas increased to 27 per cent of the primary energy mix. Gas use grew by nearly 4 per cent in 2019–20, including in the LNG production, electricity generation, manufacturing and residential sectors.

Energy production

- Energy production rose by 2 per cent in 2019–20 to 20,055 petajoules, mainly as a result of increased natural gas and oil production.
- Natural gas production grew by 8 per cent in 2019–20, underpinned by increased production in the northwest for export as LNG.
- Coal seam gas accounted for around one-quarter of Australian gas production and over two-thirds of eastern gas production in 2019–20.
- Crude oil and condensate production increased by 18 per cent in 2019–20, while naturally-occurring LPG production grew by 48 per cent, mostly associated with the increased gas production in the northwest.
- Black coal production fell by 2 per cent in 2019–20. Brown coal production fell by 4 per cent, reflecting the longer term shift away from brown coal-fired electricity generation.

Electricity generation

- Total electricity generation in Australia was steady in 2019–20 at 265 terawatt hours (955 petajoules). This figure includes industrial, rooftop solar PV and off-grid generation.
- About 16 per cent of Australia's electricity was generated outside the electricity sector by industry and households in 2019–20.
- Black and brown coal-fired electricity generation fell in 2019–20, by 7 per cent and 2 per cent respectively. Coal was 55 per cent of total generation in 2019–20 and fell further to 54 per cent in calendar year 2020.
- Natural gas-fired generation rose by 5 per cent in 2019–20, to 21 per cent of total generation, easing to 20 per cent of total generation in calendar year 2020.
- Renewable generation increased 15 per cent in 2019–20, contributing 23 per cent of total generation. This was mostly a result of a 42 per cent increase in solar generation and 15 per cent increase in wind generation, with solar and wind each contributing 8 per cent of total generation.
- Renewable generation grew further in calendar year 2020, to 24 per cent of total generation. Australia last saw a renewables share of total generation this high in the mid-1960s when the Snowy Mountains hydro-electric scheme came progressively online.
- Solar PV, especially large scale solar PV, was the fastest growing generation type in both 2019–20 and the 2020 calendar year.

Energy trade

- Most of Australia's energy production is exported. Net exports (exports minus imports) were equal to 70 per cent of production in 2019–20.
- Energy exports grew by 2 per cent in 2019–20 to 16,290 petajoules. LNG exports grew by 6 per cent to 4,393 petajoules, as new capacity came online. Associated with the new capacity, exports of crude oil and condensate grew by 15 per cent and LPG by 48 per cent.
- Energy imports fell by 7 per cent to 2,244 petajoules in 2019–20. Most imports are of refined petroleum products and crude oil and other refinery feedstock, which fell in response to lower transport demand and the associated lower refinery output.

1. About the Australian Energy Statistics

The *Australian Energy Statistics* (AES) is the authoritative and official source of annual energy statistics for Australia, covering all types of energy and all parts of the economy. It provides information designed to increase the understanding of energy supply and use in Australia, to support decision making in government, industry and more broadly, and to meet annual international energy reporting obligations. AES data also supports the calculation of greenhouse gas emissions from energy supply and use.

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 units and volume or mass units. Where possible, concepts, definitions and presentation align 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*; datasets and estimates from other Australian and state government agencies; internal estimates using statistical techniques; 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, Science, Energy and Resources (2020 to 2021); the Department of Environment and Energy (2017 to 2019); 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 previous Australian government agencies; since the mid-1970s.

The AES dataset is available online in Excel format. A list of the AES Excel tables available on the website is provided in Table 1.1. An energy flows schematic is also available on the website.

This report, the *Australian Energy Update*, highlights recent trends in Australian energy consumption, production and trade.

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

The main unit in the AES is the petajoule (PJ). One petajoule = 1×10^{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. A car using 6 litres of petrol per hundred kilometres could drive approximately 487 million kilometres on one petajoule, driving around Australia more than 33 thousand times. It's also more than three times the distance from the Sun to the Earth. One petajoule is equivalent to filling up a car with a fuel tank capacity of 55 litres of petrol around 532,000 times.

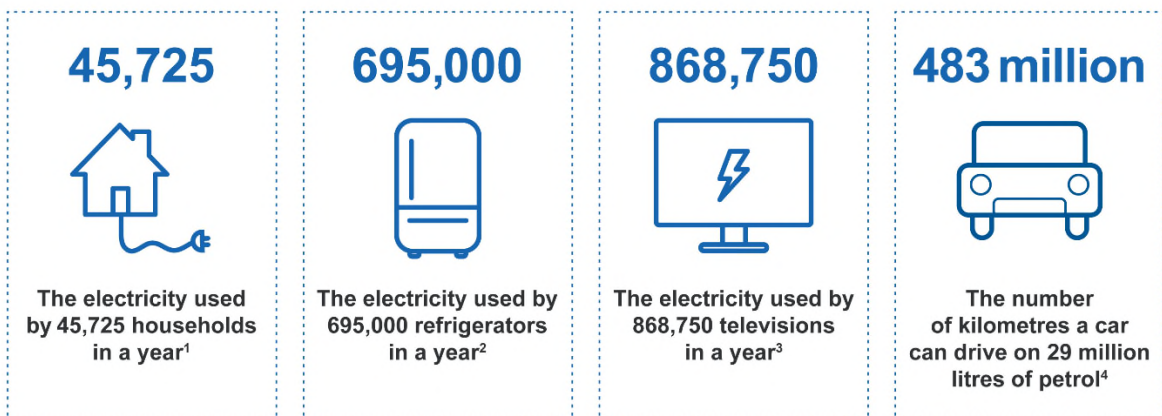
Table 1.1: 2021 Australian Energy Statistics tables

Table name	Table contents
Table A	Australian energy supply and consumption, energy units
Table B	Australian population, GDP and energy consumption, by state and territory
Table C	Australian energy consumption, by state and territory, by fuel, energy units
Table D	Australian energy consumption, by state and territory, by detailed fuel, energy units
Table E	Australian energy consumption, by state and territory, by industry, energy units
Table F	Australian energy consumption, by state and territory, by industry and fuel type, energy units
Table G	Australian energy consumption, by state and territory, by fuel, physical units
Table H	Australian total final energy consumption, by industry, by fuel, energy units
Table I	Australian production of primary fuels, by state and territory, physical units
Table J	Australian energy supply and trade, by fuel type, energy units
Table K	Australian energy consumption in 2019–20, by state and territory, by industry, selected fuels, energy units
Table L	Australian consumption of electricity, by state and territory, physical units
Table M	Australian energy imports, by fuel type, physical units
Table N	Australian energy exports, by fuel type, physical units
Table O	Australian electricity generation, by state and territory, by fuel type, physical units
Table P	Australian consumption and production of coal, by state and territory, physical units
Table Q	Australian consumption and production of gas, by state and territory, physical units
Table R	Australian production of gas, by type, state and territory, energy units
Table S	Australian production and exports of uranium, physical and energy units

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 10¹⁵ joules (1 million billion) or 278 gigawatt hours.



¹Based on the average home using approximately 22 gigajoules of electricity in 2018–19

²Based on a typical 3 star fridge using 400 kWh of electricity per year

³Based on a 55 inch 5 star label television using 320 kWh of electricity per year

⁴Based on a car consuming 6 litres of unleaded petrol per 100 kilometres

2. Energy consumption

Energy consumption measures the amount of energy used in the Australian economy. It includes energy consumed in energy conversion activities (such as electricity generation and petroleum refining), but nets off derived or secondary fuels produced domestically (such as electricity and refined oil products) to avoid double counting of energy. It is equivalent to total primary energy supply. It is equal to domestic production plus imports minus exports (and changes in stocks). Further detail is provided in Department of Industry, Science, Energy and Resources (2021) *Guide to the Australian Energy Statistics*.

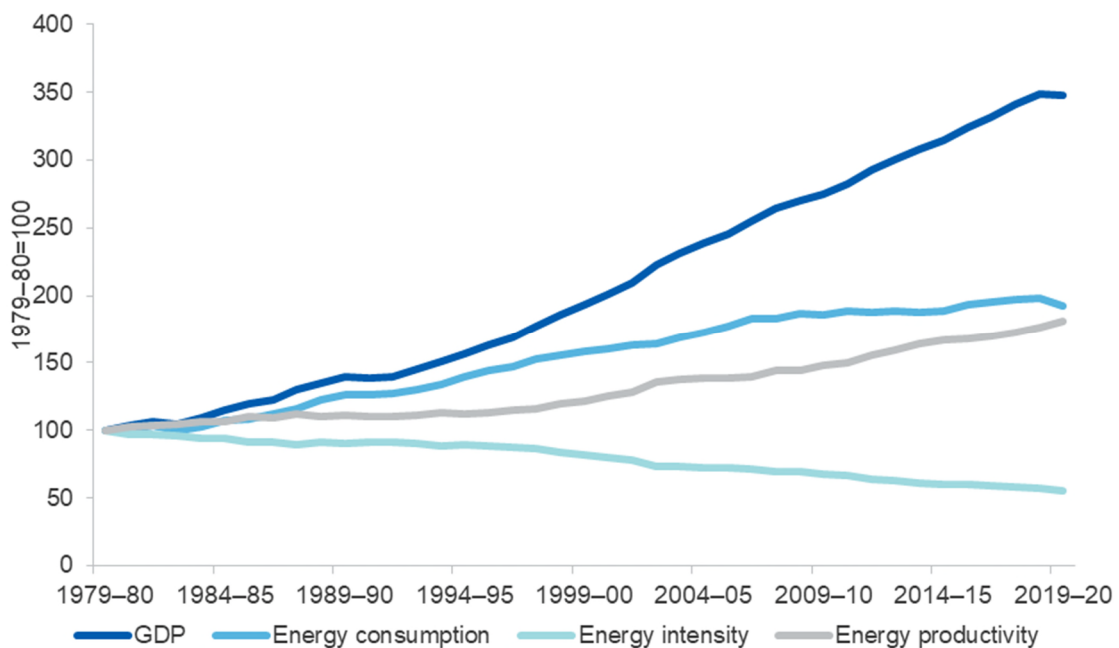
Energy consumption fell by 2.9 per cent in 2019–20 to 6,014 petajoules. This compares with average growth of 0.7 per cent a year in the prior decade (2009–10 to 2018–19). The drop in consumption in 2019–20 was 182 petajoules, the same amount of energy from filling a 55-litre tank of petrol 97 million times.

In 2019–20, the Australian economy contracted by 0.3 per cent to \$1.9 trillion. Population grew by 1.3 per cent to reach 25.7 million people.

2.1 Energy productivity

The relationship between energy use and economic output can be described in terms of the energy intensity, or inversely, the energy productivity, of the Australian economy. Energy intensity measures the amount of energy used to produce a unit of economic output (energy consumption/GDP), while energy productivity measures the amount of economic output produced per unit of energy input (GDP/energy consumption).

Figure 2.1: Australian energy intensity and energy productivity



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table B

Table 2.1: Australian population, GDP and energy consumption

	2010–11	2019–20	Average annual growth	
			2019–20 (per cent)	10 years (per cent)
Population (millions)	22.3	25.7	1.3	1.6
GDP (\$ billion)	1,580.9	1,947.1	-0.3	2.3
Energy consumption (PJ)	5,902.5	6,013.8	-2.9	0.2
Energy consumption per capita (GJ)	264.2	234.0	-4.2	-1.3
Energy intensity (GJ/\$ million)	3,733.6	3,088.6	-2.7	-2.1
Energy productivity (\$ million/PJ)	267.8	323.8	2.7	2.1

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table B

The Australian economy has shown lower energy intensity and higher energy productivity over time, as economic growth in Australia over recent decades has generally outpaced growth in energy consumption (Figure 2.1). This reflects cumulative improvements in energy efficiency as well as a shift in the Australian economy away from highly energy-intensive industries such as manufacturing towards less energy-intensive industries such as services. Increased use of renewable energy instead of fossil fuels for electricity generation has also had a positive impact on energy productivity.

Energy productivity improved by 2.7 per cent in 2019–20 and by 21 per cent over the past ten years (Table 2.1). Australia now creates \$324 million in GDP for every petajoule of energy consumed, which is over \$50 million more than a decade ago. Put another way, Australia now uses 17 per cent less energy per dollar of economic output than a decade ago. Australia also uses 11 per cent less energy per person than a decade ago.

2.2 Energy consumption, by fuel type

Fossil fuels (coal, oil and natural gas) accounted for 93 per cent of Australia's primary energy mix in 2019–20. Oil, including crude oil, liquefied petroleum gas (LPG) and refined products, accounted for the largest share of energy consumption, at 37 per cent in 2019–20 (Table 2.2).

Oil consumption includes domestic and imported crude used by Australian refineries, and imported refined products used by industry and households, but nets off refined products produced domestically to avoid double counting of energy. Oil consumption fell by 7 per cent in 2019–20 (Table 2.2), substantially below the 2 per cent annual growth rate for the previous ten years to 2018–19. This reflects a fall in both passenger road and air transport due to COVID-19 restrictions and the responding fall in crude consumption by refineries.

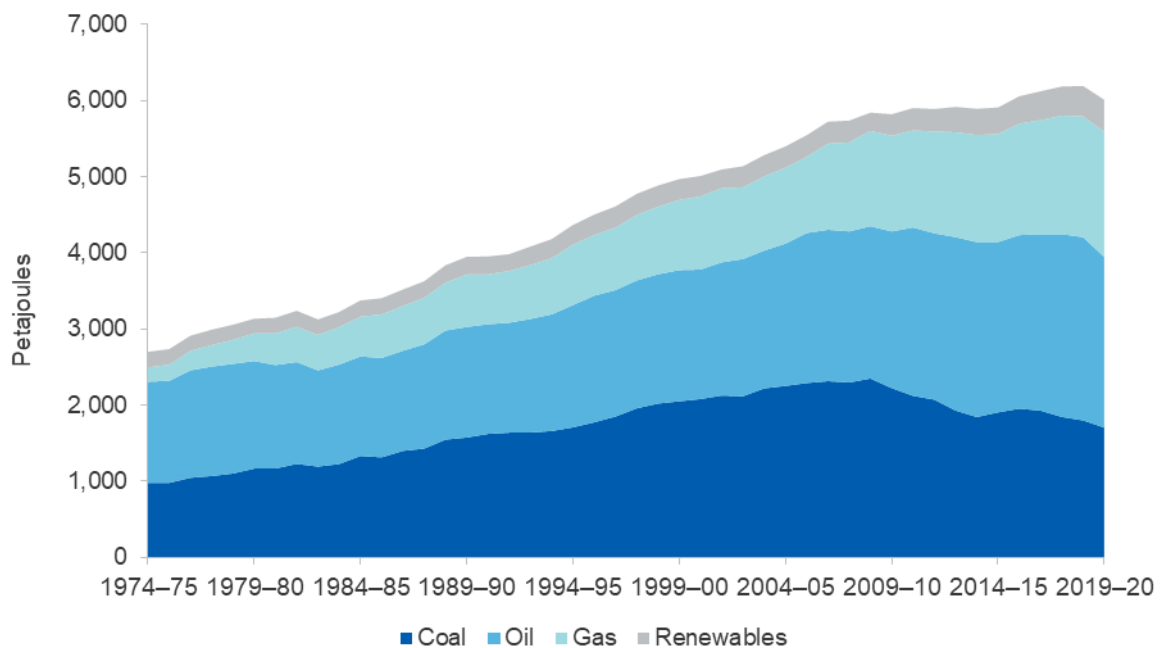
Table 2.2: Australian energy consumption, by fuel type

	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
Oil	2,241.2	37.3	-6.9	0.1
Coal	1,706.6	28.4	-5.3	-2.4
Gas	1,647.2	27.4	3.8	2.9
Renewables	418.8	7.0	4.6	4.0
Total	6,013.8	100.0	-2.9	0.2

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table C

Coal remained the second largest fuel consumed in 2019–20, accounting for 28 per cent of energy consumption (Figure 2.2). Coal consumption fell by 5 per cent in 2019–20, double the average ten year rate of decline. The decline was largely due to lower brown and black coal-fired electricity generation, which was displaced by renewable generation and gas.

Figure 2.2: Australian energy consumption, by fuel type

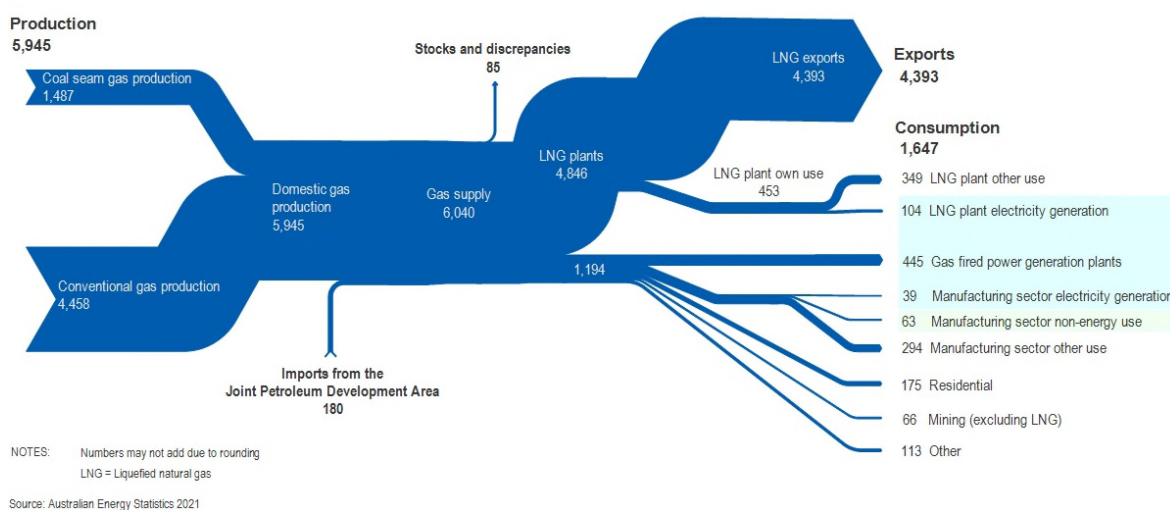


Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table C

Natural gas accounted for 27 per cent of energy consumption in 2019–20. Gas consumption rose by 4 per cent, with increased use at LNG plants to support the continued growth in LNG exports. Gas use also increased for electricity generation in response to lower gas prices, in chemicals as plants came back online after outages the previous year, in non-ferrous metals as alumina production increased, and in the residential sector as more people stayed and worked at home.

Figure 2.3: Australian natural gas flows, petajoules, 2019–20

Australian natural gas flows, petajoules, 2019-20



Note: Components may not sum due to rounding

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Tables A and F and internal sources

Around 36 per cent (588 petajoules) of Australia’s gas consumption in 2019–20 was for electricity generation, including generation by industries outside the electricity sector. Gas-fired generation by industry includes generation at smelters, refineries and mines. It also includes unprocessed natural gas used to generate electricity during the gas production process. This consumption is included in the electricity generation sector in the AES, which allocates consumption to the activity of generating electricity, rather than to the original industry such as mining and manufacturing. Figure 2.3 illustrates these different components.

When on-site electricity generation use is included, mining accounted for about 32 per cent (519 petajoules) of Australian gas use in 2019–20, with 28 per cent (453 petajoules) being consumed by LNG plants. This only includes the gas consumed by LNG plants, and does not include the gas exported as LNG.

Manufacturing accounted for 24 per cent (396 petajoules) of Australian gas use in 2019–20, when on-site electricity generation is included. Of this, around 63 petajoules was used for non-energy purposes, such as feedstock for chemicals production.

Gas is an important energy source for manufacturing, accounting for 42 per cent of manufacturing final energy use in 2019–20. The gas share of energy use in the sector has been steady at around 40 per cent for two decades despite industry structure and activity changes.

Renewable energy sources accounted for the remaining 7 per cent of Australian energy consumption in 2019–20. Renewable energy consumption comprises mainly biomass, hydro, wind and solar energy. It includes renewable energy use for electricity generation, which accounted for around 60 per cent of total Australian renewable energy use in 2019–20. It also includes direct use of renewables such as firewood for residential heating, bagasse use in manufacturing, and solar hot water.

In 2019–20, renewable energy consumption rose by 5 per cent, due to strong growth in solar and wind (Table 2.3). Renewable energy used for electricity generation increased by 12 per cent. In contrast, direct use of renewables often fluctuates from year to year, and fell by 4 per cent in 2019–20.

Table 2.3: Australian renewable energy consumption, by fuel type

	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
Biomass	169.3	40.4	-5.7	0.1
- wood and other ^a	85.5	20.4	-3.1	0.1
- bagasse	83.8	20.0	-8.2	0.1
Municipal and industrial waste	4.0	1.0	-13.2	na
Biogas	16.7	4.0	2.1	1.9
- landfill gas	12.3	2.9	2.5	na
- other biogas	4.4	1.0	0.8	na
Biofuels	6.6	1.6	-10.5	-6.9
- ethanol	5.4	1.3	-11.3	na
- biodiesel	0.1	0.0	na	na
- other liquid biofuels	1.1	0.3	-11.2	na
Hydro	54.5	13.0	-5.1	-1.1
Wind	73.4	17.5	15.2	14.4
Solar PV	75.7	18.1	41.7	33.8
Solar hot water	18.5	4.4	4.8	5.2
Total	418.8	100.0	4.6	4.0

Notes: ^a includes wood waste, charcoal, sulphite lyes and other biomass

na – not available

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Tables D, F, O and internal sources

In particular, consumption of bagasse, the remnant sugar cane pulp left after crushing, declined by 8 per cent in 2019–20 due to a smaller sugar crop in the

2019 season. However, it remained a significant source of renewable energy in Australia, at 20 per cent of total renewable energy use in 2019–20.

Wind and solar energy use have grown rapidly in the past decade, and combined were 40 per cent of all renewable energy consumption in 2019–20, up from 13 per cent a decade ago. Solar PV has grown from negligible levels a decade ago to 76 petajoules in 2019–20, growing by 42 per cent in that year. Recent strong solar growth is largely due to a rapid expansion in large-scale solar PV power stations.

Wind energy use grew by 15 per cent in 2019–20, similar to the annual rate of growth over the past decade. Hydro energy has been broadly stable over time, but declined by 5 per cent in a very dry 2019–20.

Solid municipal and industrial waste can be used to generate electricity, and provided around 4 petajoules of energy in 2019–20, about double what it was five years ago. Biogas from landfill, sewerage and other sources provided a further 17 petajoules of energy in 2019–20.

2.3 Energy consumption, by sector

The transport, electricity supply and manufacturing sectors collectively accounted for over two-thirds of energy consumption in 2019–20 (Figure 2.4).

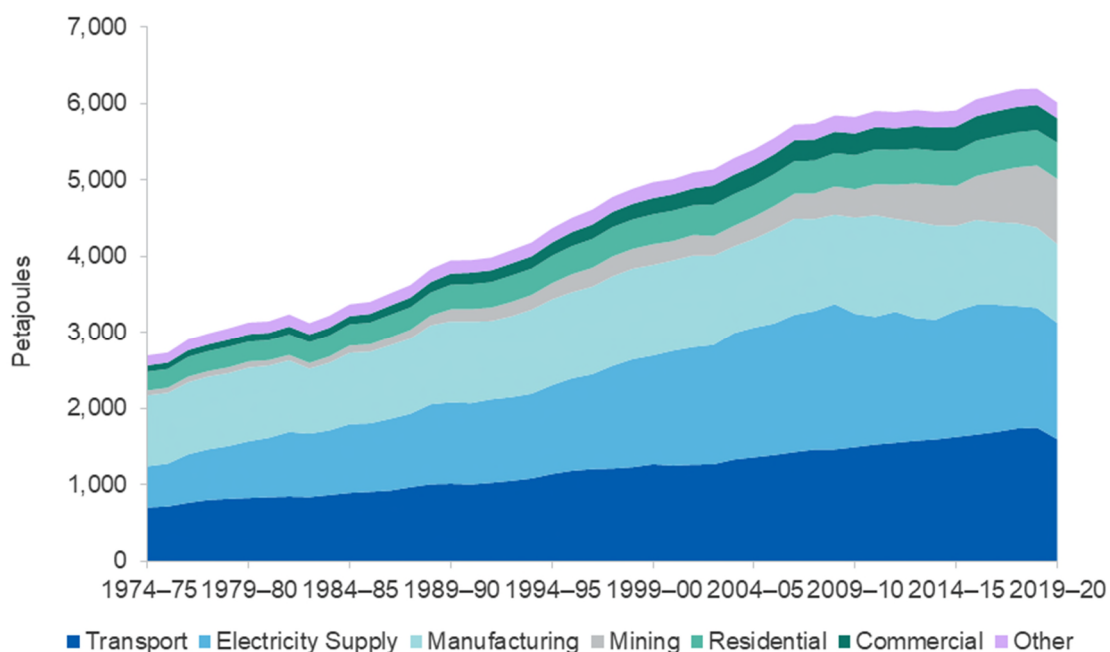
Table 2.4: Australian energy consumption, by sector

	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
Transport	1,593.7	26.5	-8.8	0.5
Electricity supply	1,534.5	25.5	-2.8	-1.0
Manufacturing	1,030.9	17.1	-1.9	-2.8
Mining	853.6	14.2	5.1	8.6
Residential	473.3	7.9	2.7	0.5
Commercial	321.2	5.3	-3.1	1.1
Agriculture	88.0	1.5	-11.0	-1.0
Construction	40.4	0.7	-5.6	2.5
Water and waste	20.1	0.3	21.8	4.9
Other	58.1	1.0	4.0	-2.1
Total	6,013.8	100.0	-2.9	0.2

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table E

The electricity supply sector accounted for 26 per cent of energy consumption in 2019–20 (Table 2.4). Energy consumption in this sector (including fuel inputs to electricity generation, own use of electricity, and losses) declined by 3 per cent during this period, despite flat electricity output.

Figure 2.4: Australian energy consumption, by sector



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table E

Lower consumption in the electricity supply sector reflects a shift from fossil fuel generation with thermal losses to non-thermal renewable generation sources. When measuring primary energy consumption, a change in thermal electricity generation has a greater effect than a change in some renewable generation such as wind, solar and hydro, because the energy of these renewables is measured when turned into electricity.

For example, if wind generation rises by 1,000 gigawatt hours, then energy consumption would rise by 3.6 petajoules, because the electricity generated is measured. If coal-fired generation rises by 1,000 gigawatt hours, then energy consumption would increase by the amount of coal consumed to generate the electricity, which would be around 10 petajoules (assuming an efficiency of 35 per cent).

Transport energy consumption fell by 9 per cent in 2019–20 (Table 2.5) as a result of the impacts of COVID-19 restrictions on passenger air and road transport from March 2020. This was the first time that annual transport energy use has fallen in nearly twenty years. However, transport remained the largest share of Australian energy consumption.

Road transport accounted for nearly three-quarters of total transport energy consumption in 2019–20. Most of the recent growth in road transport energy consumption has been in diesel usage, supported by steady economic and population growth and switching to diesel vehicles by consumers (Figure 2.5). The diesel vehicle fleet (including passenger, light commercial and freight) has more than doubled in size since 2011, to 5.3 million vehicles in 2021 (ABS 2021a) (Figure 2.6).

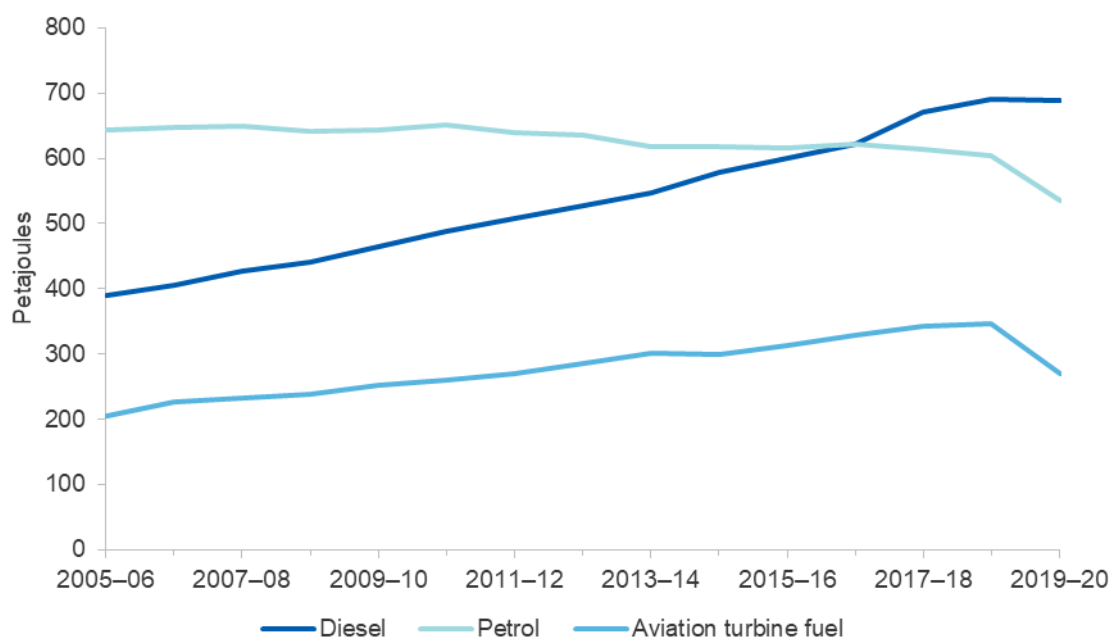
Road transport diesel consumption fell only slightly in 2019–20, with any decline passenger usage offset by continued freight activity, which was relatively unaffected by COVID-related restrictions from March 2020. Diesel sales rose in March 2020, possibly in response to increased retail spending. Further details on COVID-19 impacts are provided in Chapter 5.

Table 2.5: Australian transport energy consumption, by subsector

	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
Road	1,159.0	72.7	-6.1	0.2
Air	272.6	17.1	-22.0	0.4
Water	60.6	3.8	-4.1	0.3
Rail	62.0	3.9	-1.4	4.0
Other	39.6	2.5	5.7	6.8
Total	1,593.7	100.0	-8.8	0.5

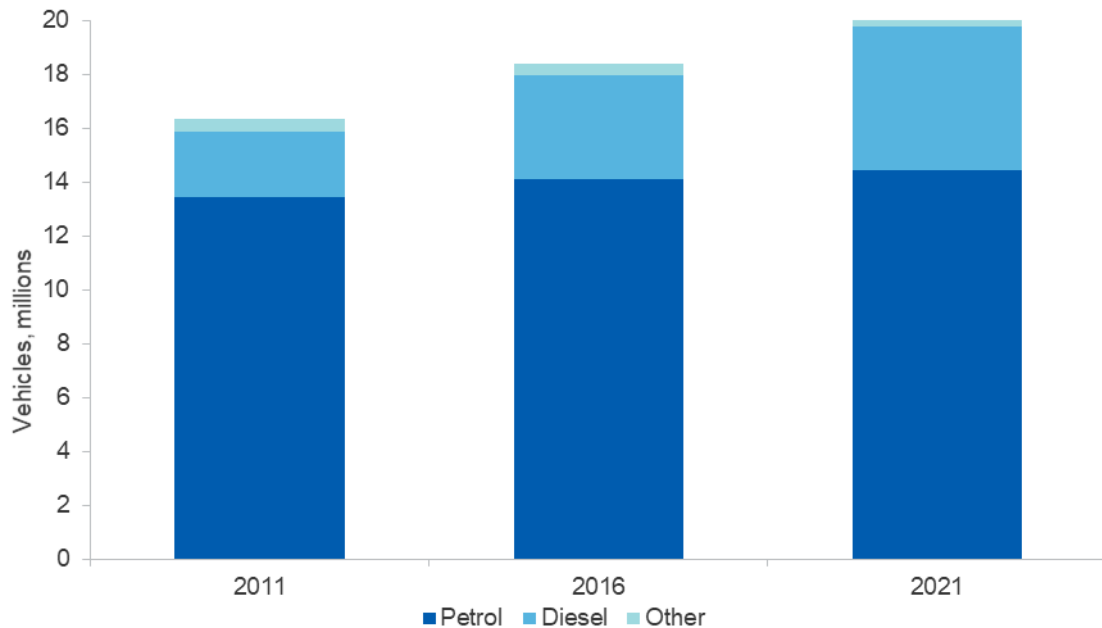
Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table F

Figure 2.5: Australian transport energy consumption, by major fuel type



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table F

Figure 2.6: Australian motor vehicle registrations, by fuel type



Source: Australian Bureau of Statistics (2021a) *Motor Vehicle Census, Australia, 31 Jan 2020*, formerly cat. no. 9309.0

In contrast, petrol consumption, used mostly for road passenger movement, fell sharply by 11 per cent in 2019–20. Prior to this year, petrol consumption had declined by about 6 per cent for the decade as a whole.

Air transport accounted for a further 17 per cent of total transport energy use in 2019–20. Use of jet fuel fell markedly in 2019–20, by 22 per cent, as domestic and especially international passenger aviation largely shut down from March 2020. Domestic and international passenger numbers in June quarter 2020 were more than 95 per cent lower than the same period in 2019. (BITRE 2021). This came after a long period of steady annual growth.

Energy consumption in the manufacturing sector fell about 2 per cent in 2019–20. (Table 2.6), with a decline in every subsector except for chemicals. Energy consumption in the chemicals sector grew by 2 per cent in 2019–20. This was largely a rebound from the previous year, which had been marked by some major plant outages.

Around half of food manufacturing energy consumption is the burning of cane waste (bagasse) for energy. The 8 per cent decline in bagasse consumption in 2019–20, associated with a smaller sugar harvest, saw energy use in the food manufacturing sector drop by 4 per cent in 2019–20.

Energy use in ferrous metals manufacturing fell by 1 per cent, in line with slightly decreased steel production (DISER 2020d), the main activity of the sector. Process and input changes for furnaces in recent years are also reported to have reduced raw material needs in steel manufacturing.

Energy use also fell in the petroleum refining sector, with refinery output falling by 10 per cent in 2019–20 in response to reduced demand for refined products.

Table 2.6: Australian manufacturing energy consumption, by subsector

	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
Non-ferrous metals	329.6	32.0	-1.2	-1.7
Chemicals	191.3	18.6	2.4	-1.2
Food, beverages, tobacco	140.5	13.6	-4.1	-0.8
Ferrous metals	113.9	11.0	-0.6	-3.9
Petroleum refining ^a	79.6	7.7	-5.4	-9.2
Wood, paper and printing	52.2	5.1	-3.7	-2.0
Cement	50.0	4.8	-3.0	-3.7
Other	73.9	7.2	-7.7	-3.0
Total^b	1030.9	100.0	-1.9	-2.8

Notes: ^a Energy consumption in petroleum refining equals total energy consumption (feedstock and own use) minus derived fuel production. The derived fuel production is netted off to avoid double counting of this energy in other sectors.

^bConsumption excludes consumption for generation of electricity, which is recorded in Electricity supply sector.

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table F

Energy use in other manufacturing, a diverse sector containing mostly less energy-intensive activities and many smaller businesses, fell by 8 per cent in 2019–20, reflecting lower output and employment levels.

Natural gas continued to be the largest source of energy for the manufacturing sector, and its consumption in manufacturing increased by 1 per cent in 2019–20. This was mainly in chemicals as plants came back online after outages the previous year, and in non-ferrous metals as alumina production increased.

Energy consumption in the mining sector was approximately 854 petajoules in 2019–20, up 5 per cent on the previous year (Table 2.7). This is lower than average growth in mining energy use over the past decade.

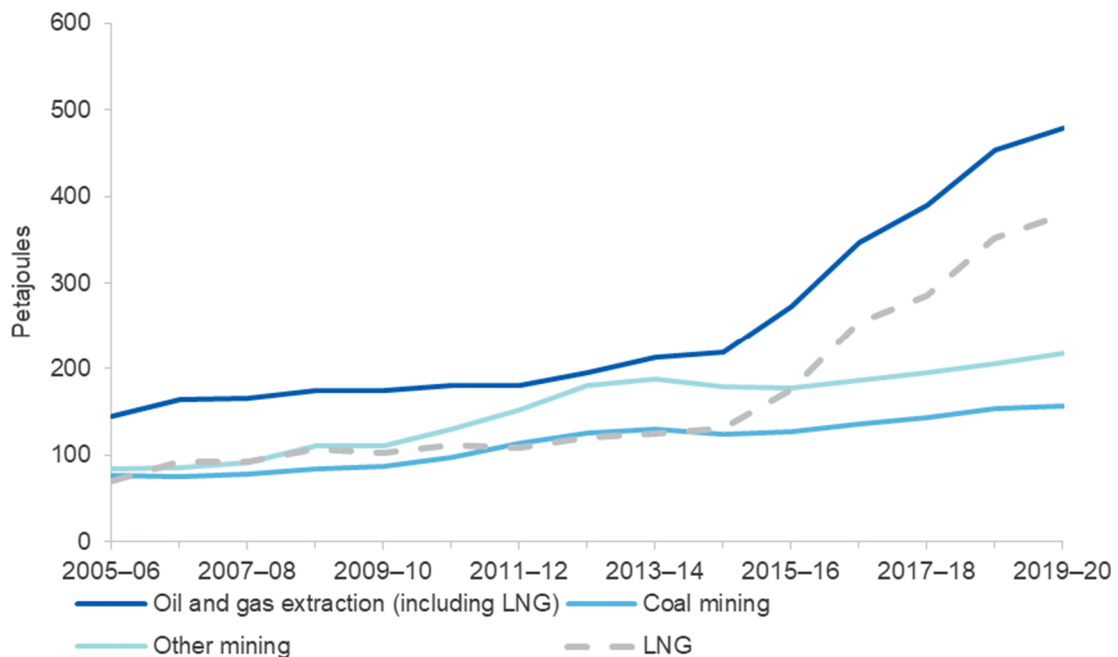
Table 2.7: Australian mining energy consumption, by subsector

	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
Oil and gas	478.2	56.0	5.6	11.4
- LNG	378.0	44.3	7.5	14.4
Coal	157.6	18.5	2.6	5.5
Other mining	217.7	25.5	5.8	5.9
Total	853.6	100.0	5.1	8.6

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table F and internal sources

Much of the growth in 2019–20 was due to growth in natural gas extraction and subsequent liquefaction at LNG plants (Figure 2.7). This is underpinned by new capacity in the northwest, with the first full year of operation of the Ichthys LNG project.

Figure 2.7: Australian energy consumption in mining



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table F and internal sources

In 2019–20, own-use natural gas consumption at Australia’s LNG facilities increased to 378 petajoules, supporting growth of LNG exports from 75 to 79 million tonnes. This excludes gas used for electricity generation at gas processing and liquefaction plants of around 104 petajoules, which is included in the electricity generation sector of the AES. In total, LNG plants now account

for over one-quarter of Australia's gas consumption, up from around one-tenth a decade ago. The mining sector also includes electricity consumption at these facilities.

In the agriculture sector, energy use fell by 11 per cent in 2019–20. The drought conditions affected crop and livestock production, which in turn lowered energy demand for agricultural operations (ABARES 2021). Dry conditions also led to a 22 per cent increase in energy consumption in the relatively small water and waste sector, as water utilities activated desalination plants or otherwise expended more energy to move and supply water.

Commercial and services energy consumption fell by 3 per cent in 2019–20, partly due to reduced activity as a result of COVID-19 stay-at-home rules from March 2020. In 2019–20 as a whole, commercial sector output measured by industry value added was essentially static, although fell in the June quarter of 2020 (ABS 2020b).

Energy consumption in the residential sector grew 3 per cent in 2019–20. This growth was well above the long term trend of efficiency-driven declining per-household energy consumption, and was a result of COVID-19 stay-at-home restrictions from March 2020. In large part, the increase was a transfer of the reduction in commercial and services consumption. Residential sector consumption includes the use of electricity generated from rooftop solar photovoltaic (PV) systems and from the grid.

2.4 Final energy consumption

Final energy consumption is the energy used by the final or end-use sectors, and is a subset of total energy consumption. Final energy is suited to the measurement of energy demand by the final consumer. 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, as are fuels used in coke ovens and blast furnaces in iron and steel manufacturing.

Final energy consumption decreased by 3 per cent in 2019–20 (Table 2.8 and Table 2.9). This compares to a growth rate over the prior ten years of around 2 per cent a year. Most of this is the decline in transport, agriculture, commercial and some manufacturing sub-sectors outlined earlier in the chapter.

In 2019–20, refined petroleum products accounted for around half of Australia's final energy consumption, followed by natural gas and electricity. Final natural gas consumption excludes gas consumed to generate electricity.

Refined petroleum product consumption is around 2.5 times larger than electricity consumption. Consumption of diesel alone has surpassed electricity consumption in recent years (Figure 2.8).

Table 2.8: Australian total final energy consumption, by fuel

	2019–20		Average annual growth	
	PJ	share	2019–20 (per cent)	10 years (per cent)
		(per cent)		
Coal	102.1	2.4	-7.6	-1.3
Gas	1,011.8	23.7	3.3	3.4
Refined products	2,124.6	49.8	-6.9	0.6
Electricity	857.7	20.1	0.5	0.7
-Generated from coal	470.7	11.0	-5.7	-1.9
-Generated from gas	178.6	4.2	4.6	1.3
-Generated from oil	14.6	0.3	-8.4	4.3
-Generated from renewables	193.8	4.5	15.2	9.5
Renewables	170.3	4.0	-4.2	-0.7
Total	4,266.6	100.0	-3.1	1.1

Notes: Total Final Energy Consumption excludes the coal, gas, renewables and other energy used for electricity generation and other conversion.

Electricity consumption breakdown by generation source is derived from total generation share.

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Tables H and O

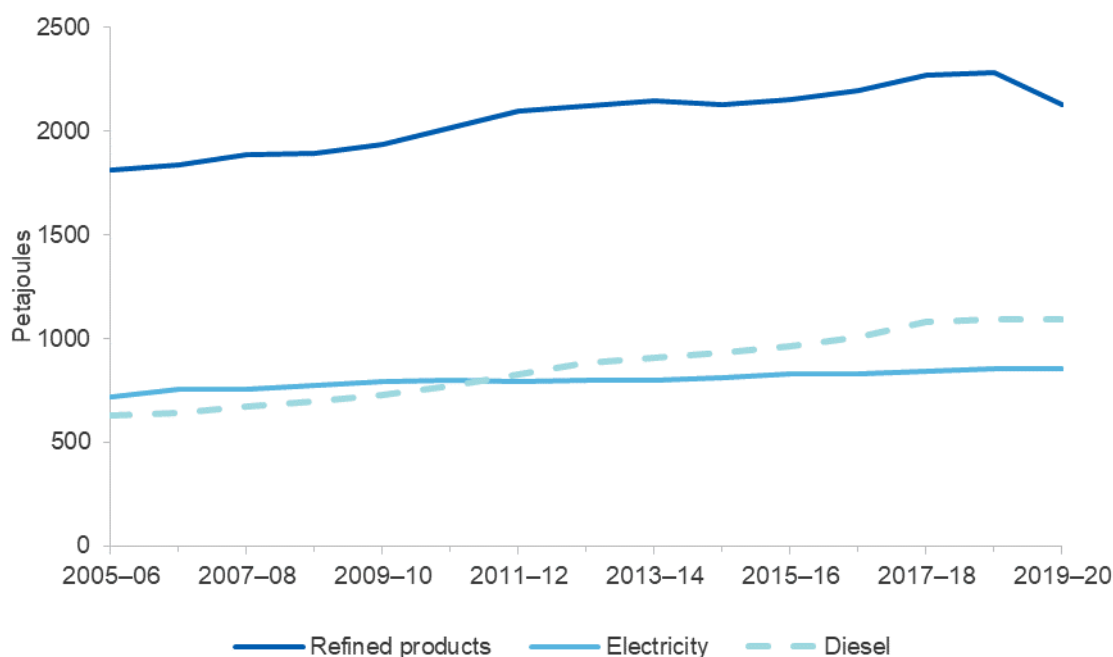
Table 2.9: Australian total final energy consumption, by industry

	2019–20		Average annual growth	
	PJ	share	2019–20 (per cent)	10 years (per cent)
		(per cent)		
Agriculture	88.0	2.1	-11.0	-1.0
Mining	853.6	20.0	5.1	8.6
Manufacturing	846.1	19.8	-1.8	-1.8
Construction	40.4	0.9	-5.6	2.5
Transport	1,573.8	36.9	-8.9	0.4
Water and Waste	20.1	0.5	21.8	4.9
Commercial	321.2	7.5	-3.1	1.1
Residential	473.3	11.1	2.7	0.5
Other	50.2	1.2	2.0	-1.9
Total	4,266.6	100.0	-3.1	1.1

Note: Energy consumption in some sectors differs from Table 2.4 due to exclusion of energy used for conversion activities and for own use in conversion sectors, such as electricity generation, petroleum refining and coke ovens.

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table H

Figure 2.8: Australian final energy consumption, refined products and electricity



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Tables F and H

2.5 Energy consumption, by state and territory

In 2019–20, only Western Australia and Northern Territory saw increased energy use, in both cases due to increased mining sector energy consumption. Energy use in all other states fell (Table 2.10).

Table 2.10: Australian energy consumption, by state and territory

	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
New South Wales ^a	1,468.8	24.4	-5.1	-1.4
Victoria	1,235.6	20.5	-5.3	-1.8
Queensland	1,477.5	24.6	-2.5	1.9
Western Australia	1,271.9	21.2	0.5	2.9
South Australia	312.7	5.2	-2.7	-1.0
Tasmania	99.4	1.7	-7.6	-1.5
Northern Territory	147.9	2.5	11.2	4.5
Total	6,013.8	100.0	-2.9	0.2

^a Includes Australian Capital Territory

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table C

Due to COVID-19 movement restrictions from March 2020, transport energy consumption fell substantially in all states and territories. The scale of the decline ranging from over 10 per cent in New South Wales, Northern Territory and Victoria to a smaller 5 per cent in South Australia.

Energy consumption declined in the electricity generation sector in all states except Western Australia. With generation levels broadly flat, reduced consumption was caused by the replacement of thermal generation sources such as coal, gas and bagasse with non-thermal renewables.

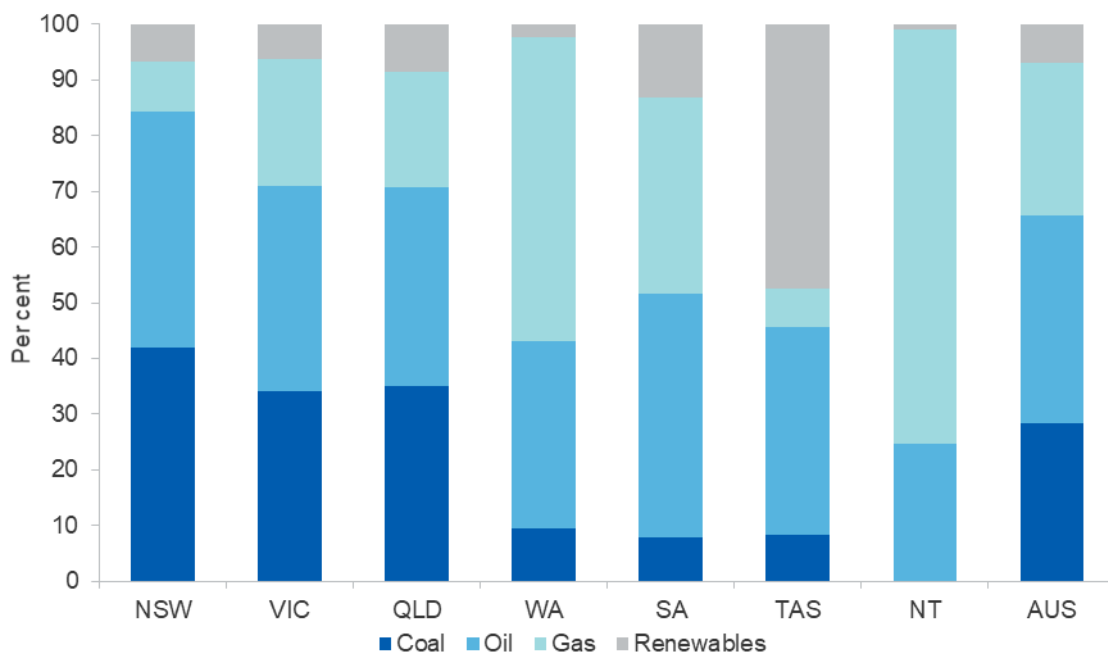
Solar power was the main thermal-displacing electricity source in Queensland and South Australia, in Tasmania it was wind power, and in New South Wales and Victoria a mixture of solar and wind power.

Northern Territory energy use grew by 11 per cent, attributable mostly to new LNG production entering its first full year of operation. Western Australian energy consumption growth of 1 per cent was attributable to higher metal ore mining energy use offsetting other declines, principally in transport energy use.

New South Wales and Victoria both recorded energy consumption declines of around 5 per cent. With those two states representing nearly half of Australian energy use, these declines constituted over 80 per cent of Australia's national drop in energy consumption in 2019–20.

In relative terms, the largest decline in energy consumption was 8 per cent in Tasmania. Aside from COVID-19 restriction factors, part of the decline was due to sharply reduced natural gas use for electricity generation at the Tamar Valley Power Station which previously provided baseload power but was only used for peaking in 2019–20 (TER 2020).

Figure 2.9: Australian energy mix, by state and territory, 2019–20



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table C

The mix of energy sources used in each state varies widely, driven by factors such as electricity generation and liquefied natural gas exports (Figure 2.9).

All six states' energy use includes oil as over a one-third share, which reflects the importance of oil products to transport activities in Australia. Over half of all energy use is natural gas in Northern Territory (74 per cent) and Western Australia (55 per cent). LNG plants in these two jurisdictions consume natural gas as they liquefy it for export, and gas is also the majority source for electricity generation.

Tasmania (48 per cent) and South Australia (13 per cent) are proportionally the heaviest users of renewable energy, especially due to hydro power in Tasmania and wind and solar power in South Australia. Western Australia at 2 per cent and Northern Territory at 1 per cent have the lowest shares of renewable energy.

New South Wales' energy mix contains the largest share of coal, 41 per cent, due to the high percentage of electricity generation from coal. Northern Territory uses no coal and the coal shares in Western Australia, South Australia and Tasmania are also below 10 per cent.

3. Energy production

3.1 Primary production

Energy production is defined as the total amount of primary energy produced in the Australian economy, measured before consumption or transformation into secondary energy products. Forms of renewable energy that produce electricity directly without a thermal component, such as wind, hydro and solar PV, are also considered primary energy sources. Coal-fired electricity generation is considered secondary energy production and is not included, as the coal is already accounted for when mined.

Table 3.1: Australian energy production, by fuel type

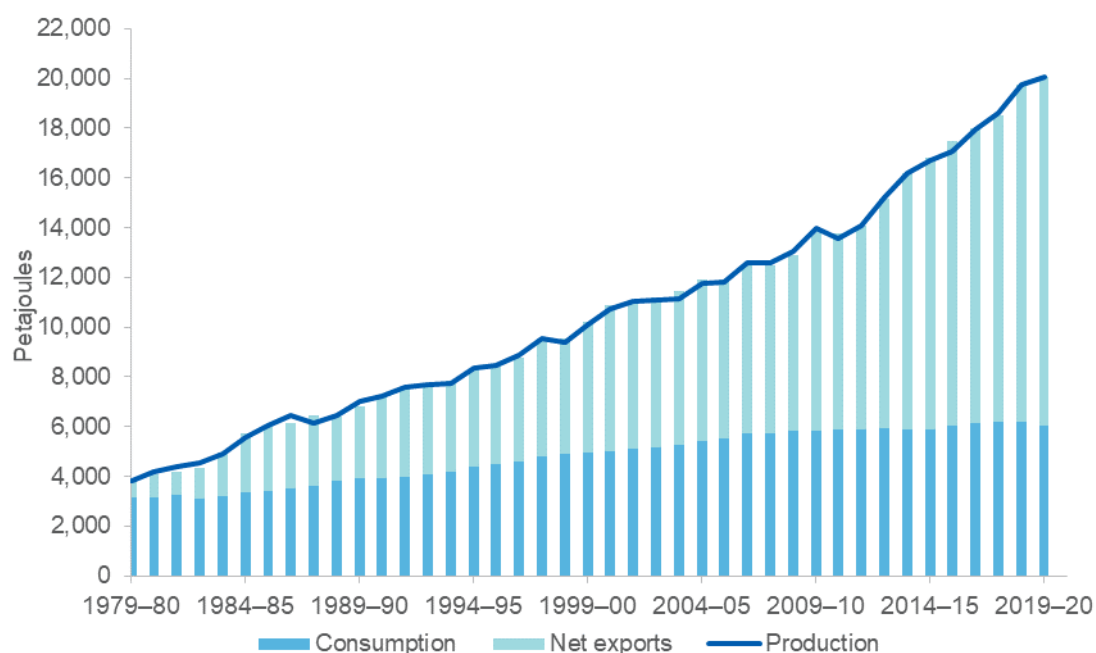
	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
Black coal	12,316.8	61.4	-2.2	3.2
Brown coal	425.4	2.1	-4.3	-5.9
Natural gas	5,944.9	29.6	7.9	11.3
Oil and NGL	798.4	4.0	18.0	-1.9
LPG	151.0	0.8	47.8	5.9
Renewables	418.8	2.1	4.6	4.0
Total	20,055.3	100.0	1.7	4.4

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table J

Production of primary energy increased by 2 per cent in 2019–20, to the highest ever level of 20,055 petajoules (Table 3.1, Figure 3.1). Natural gas production and to a lesser extent crude oil and natural gas liquids were the main drivers of this growth.

Australia is a substantial net exporter of energy, including coal and natural gas, with net exports equating to over two-thirds of production (Figure 3.1). 90 per cent of black coal energy production and 74 per cent of natural gas energy production were exported in 2019–20.

Figure 3.1: Australian energy balance



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Tables C and J

Black coal production fell by 2 per cent in 2019–20 to 12,317 petajoules (451 million tonnes), and remained Australia’s largest contributor to energy production. New South Wales and Queensland produce almost all black coal in Australia.

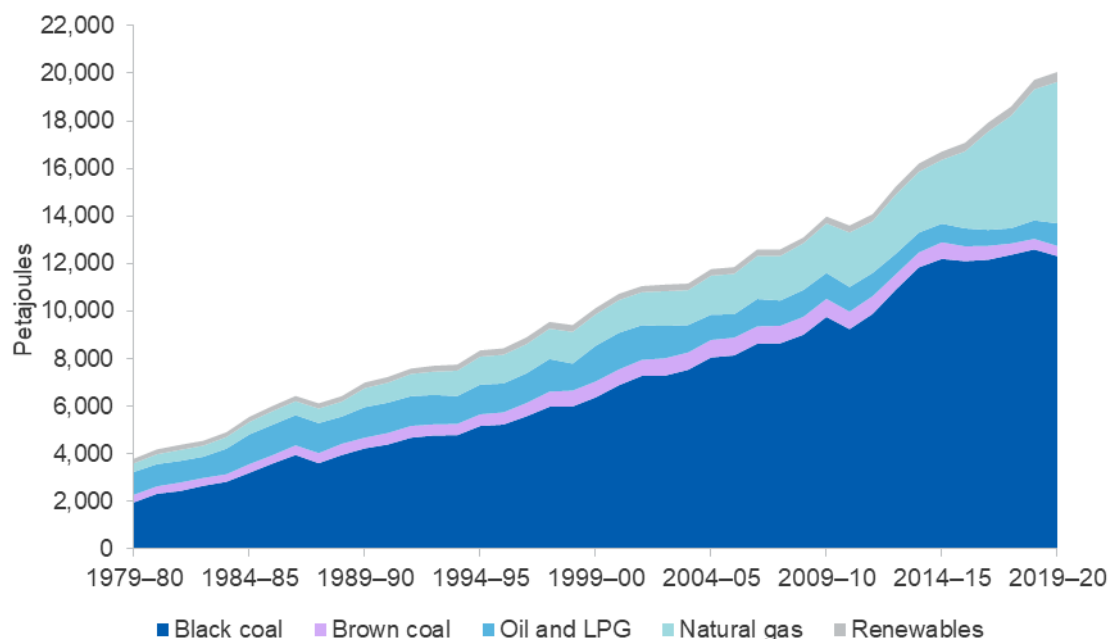
Brown coal production fell in 2019–20, by 4 per cent to 425 petajoules (42 million tonnes). Almost all brown coal produced in Australia is used for electricity generation, with a continued decline in brown coal-fired generation driving down production. Brown coal production is now roughly half (56 per cent) of its peak production in 2009–10.

Natural gas production rose by 8 per cent in 2019–20 to 5,945 petajoules (157 billion cubic metres) to support additional LNG exports, as well as higher domestic demand. Western Australia remained Australia’s largest producer of natural gas with 3,718 petajoules (98 billion cubic metres), well over half of total gas production.

Queensland gas production of 1,521 petajoules (41 billion cubic metres) in 2019–20 was over triple what it was five years prior in 2014–15. Coal seam gas accounted for around one-quarter of Australian gas production on an energy content basis, and over two-thirds of east coast gas production.

Australia produced 798 petajoules (22 billion litres) of crude oil and natural gas liquids in 2019–20, an increase of 18 per cent. Australia saw a long-term decline in production of crude oil and natural gas liquids up until last year as mature fields declined, but the opening of new natural gas liquids production in the north west associated with LNG export developments, such as the Ichthys project, took Australian oil production back to a level seen seven years ago.

Figure 3.2: Australian energy production, by fuel type



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table J

Naturally-occurring LPG production grew by 48 per cent to 151 petajoules (6 billion litres) in 2019–20, also due to a full year of production at the recently commenced Ichthys project in the northwest. Propane and butane, the components of LPG, often occur in small quantities alongside hydrocarbons such as crude oil and natural gas, meaning growing production of those commodities can also increase LPG production.

Renewable energy production increased by 5 per cent in 2019–20 to reach 419 petajoules. Wind and solar were the major sources of growth. Renewable energy accounted for 2 per cent of total energy production in 2019–20.

Australia also produces uranium oxide, which is exported for use in nuclear power plants overseas. Uranium oxide production fell 4 per cent in 2019–20 to 7,349 tonnes. The International Energy Agency (IEA) measures the energy of nuclear fuels by the heat content of steam produced in nuclear reactors. Uranium oxide is therefore not counted towards primary energy production until used in nuclear reactors outside Australia. Australia has no nuclear power generation.

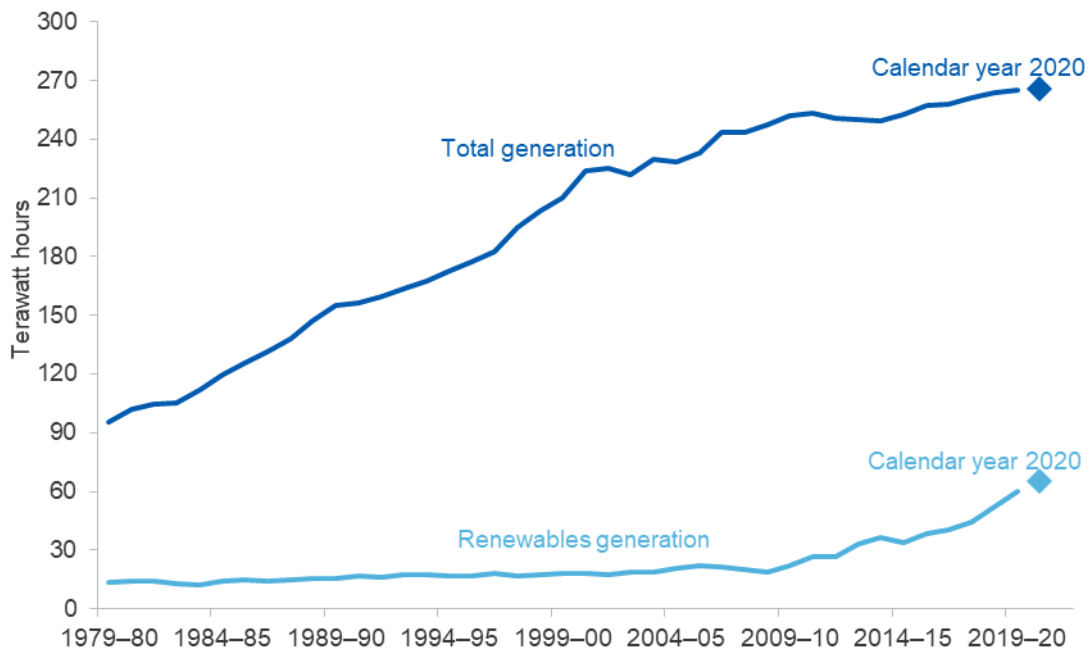
3.2 Electricity generation

In 2019–20 total electricity generation in Australia grew modestly to around 265 terawatt hours (955 petajoules), the highest total generation on record for Australia (Figure 3.3). COVID-19 affected sectoral usage and time of demand, but had limited impact on overall demand for electricity for the year as a whole.

Figure 3.3 captures all electricity generation in Australia. In addition to power plant output, it includes rooftop solar PV generation, generation by industrial facilities such as in mining and manufacturing, off-grid generation, and

electricity consumed by the generating entity. The inclusion of these components contributes to the difference in generation to that reported by the Australian Energy Market Operator.

Figure 3.3: Australian electricity generation



Sources: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table O; International Energy Agency (2021), *World Energy Balances*

Electricity generation decreased in 2019–20 in New South Wales by 2 per cent, in Tasmania by 1 per cent and was steady in Queensland. Generation increased in other states, with Victoria and South Australia somewhat offsetting the New South Wales and Tasmania decreases within the interconnected National Electricity Market.

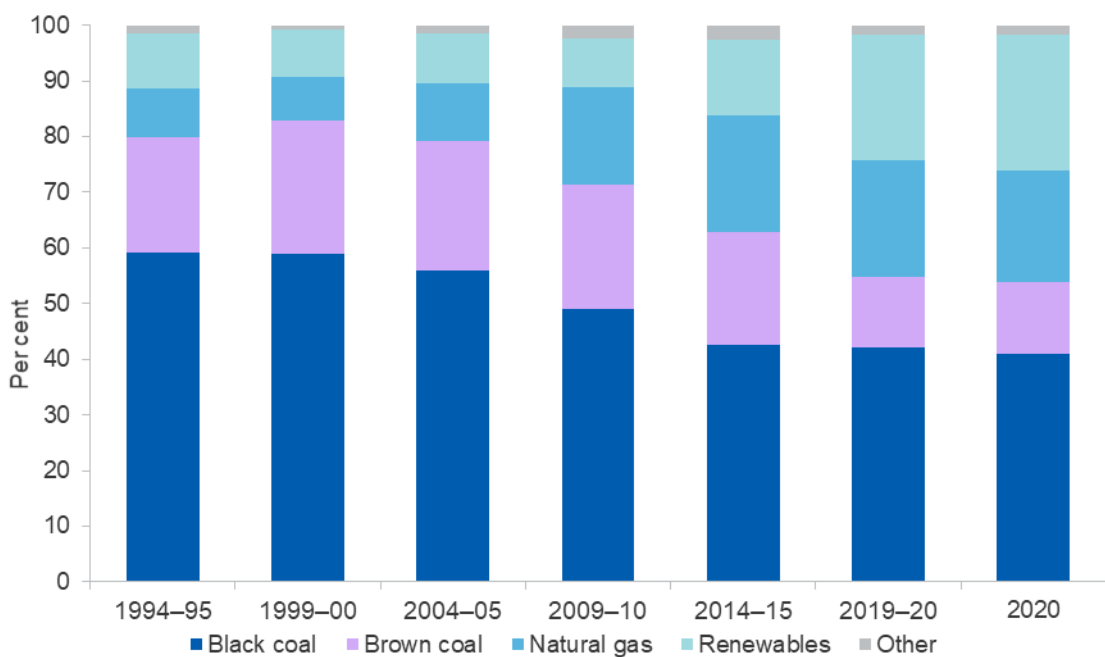
About 16 per cent of Australia’s electricity was generated outside the electricity sector, by industry and households. This share varies considerably across state and territories. 43 per cent of electricity in Western Australia and 55 per cent in Northern Territory was generated outside the electricity sector, mostly by the mining and manufacturing sectors (Figure 3.4). This figure is estimated using the industry classification reported by the facility, and does not differentiate between on-grid and off-grid generation.

Figure 3.4: Australian electricity generation, by industry, 2019–20



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table O

Figure 3.5: Australian electricity generation fuel mix



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table O

Coal-fired generation fell by 6 per cent in 2019–20, with black coal-fired generation falling 7 per cent and brown coal-fired generation falling 2 per cent (Table 3.2). Coal remained the major source for electricity generation, although its share in the fuel mix declined to 55 per cent in 2019–20 (Figure 3.5).

Table 3.2: Australian electricity generation, by fuel type

	2019–20		Average annual growth	
	GWh	share (per cent)	2019–20 (per cent)	10 years (per cent)
Fossil fuels	205,248	77.4	-3.2	-1.1
Black coal	111,873	42.2	-6.7	-0.5
Brown coal	33,649	12.7	-2.4	-5.4
Gas	55,216	20.8	4.6	1.3
Oil	4,509	1.7	-8.4	4.3
Renewables	59,930	22.6	15.2	9.5
Hydro	15,150	5.7	-5.1	-1.1
Wind	20,396	7.7	15.2	14.4
Bioenergy	3,352	1.3	-4.1	5.3
- bagasse	1,167	0.4	-9.4	na
- wood, woodwaste	381	0.1	-4.3	na
- municipal, industrial waste	34	0.0	-43.6	na
- sulphite lyes, biofuels	416	0.2	-0.4	na
- landfill biogas	1,105	0.4	1.9	na
- sludge biogas	248	0.1	0.1	na
Solar PV	21,033	7.9	41.7	33.8
- small scale	13,897	5.2	25.0	27.8
- large scale	7,136	2.7	91.2	na
Total	265,178	100.0	0.4	0.5

na – not available

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table O

Natural gas-fired generation grew by 5 per cent in 2019–20 in response to lower gas prices, and accounted for 21 per cent of Australia’s electricity generation. Its share of the generation mix has been relatively stable in recent years. Gas-fired generation fell in Victoria, South Australia and Tasmania in 2019–20 but increased in other states, especially Northern Territory and New South Wales.

Oil-fired generation fell by 8 per cent in 2019–20 and contributed under 2 per cent of Australia’s electricity generation. Oil-fired generation fell by 37 per cent in the Northern Territory, displaced by growing natural gas generation.

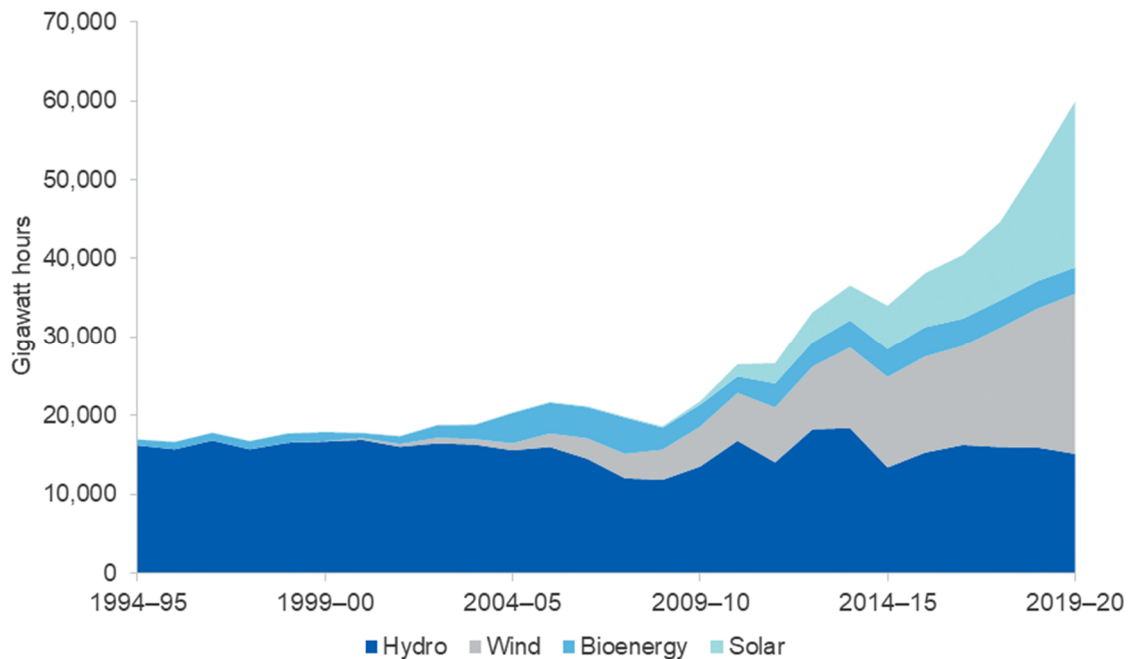
Renewable energy accounted for 23 per cent of Australia’s electricity generation in 2019–20, increasing by 15 per cent. Renewable generation grew further in the 2020 calendar year, which will be discussed in the next section.

Solar power overtook wind to be the largest contributor to renewable generation, with a 35 per cent share of renewable generation in 2019–20 and 8 per cent of total electricity generation in Australia (Figure 3.6). Solar growth has been very rapid in recent years and grew by 42 per cent in 2019–20. Small-scale solar PV grew by 25 per cent in 2019–20, but the most growth was in the installation of new large-scale PV power plants. Large-scale solar PV generation nearly doubled in 2019–20 as new capacity continued to come online (Figure 3.7).

Wind generation rose by 15 per cent in 2019–20 to contribute 8 per cent of total generation. Wind generation continues to be particularly prevalent in South Australia, accounting for nearly 40 per cent of the total generation mix in that state.

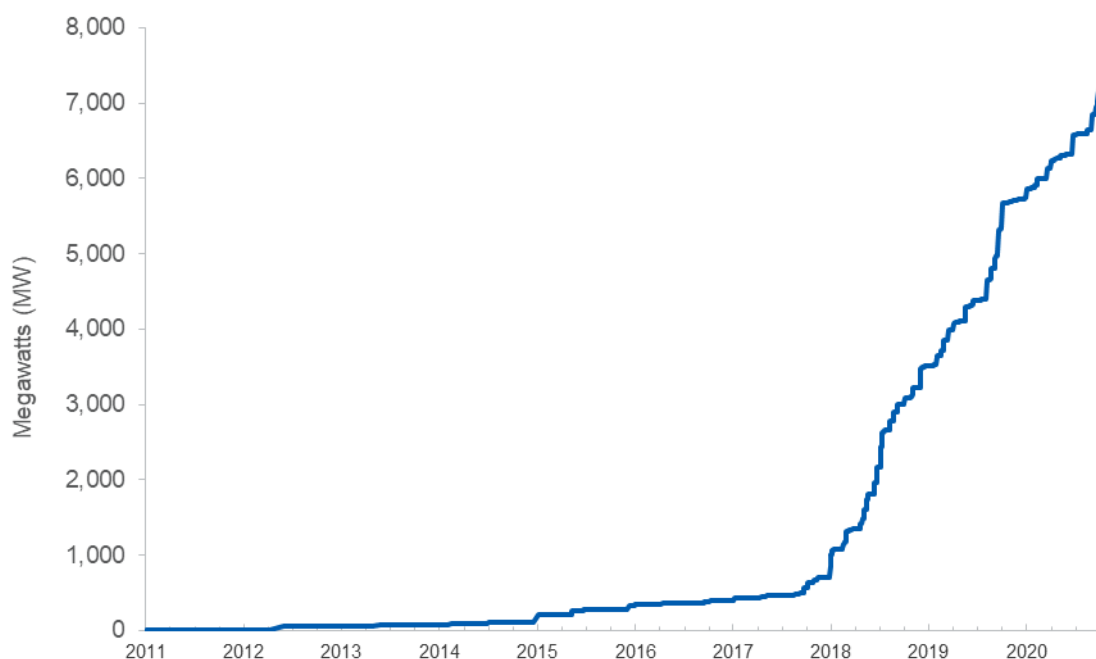
Hydro power accounted for 6 per cent of total generation. Its decline in 2019–20 reflected the dry conditions. As the composition of renewable energy has diversified significantly in Australia, the share of hydro in total renewable generation has fallen from 95 per cent in 2000–01 to 25 per cent in 2019–20.

Figure 3.6: Australian electricity generation from renewable sources, by fuel



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table O

Figure 3.7: Cumulative capacity of Clean Energy Regulator accredited large-scale solar power stations



Source: Clean Energy Regulator (2021), *Historical Large-scale Renewable Energy Target supply data*

The use of bioenergy for electricity generation has long been a part of Australia's electricity mix through the use of bagasse to generate electricity. Bagasse is still the predominant source of electricity from bioenergy, but in recent years bioenergy generation has diversified to include more generation from other sources. Bioenergy generation was down by 4 per cent in 2019–20, with a 9 per cent decline in bagasse generation driving the trend, although most other forms of generation also saw declines. In contrast, landfill biogas generation rose by 2 per cent.

3.3 Estimated electricity generation in calendar year 2020

The trends in generation in 2019–20 discussed in the previous section are important contributors to trends in Australia's overall energy supply and use in that year. More recent estimates of electricity generation were published in June 2021 for the calendar year 2020, to improve the availability of up-to-date official data on total generation in Australia. The calendar year numbers are estimates drawn from a number of different sources as there is no reliable single source of calendar year data available. The methodology differs from the financial year estimates, which are largely based on data from NGERs. Please see the Guide to the Australian Energy Statistics for more information.

Total electricity generation in Australia was estimated to be 265 terawatt hours in calendar year 2020, essentially steady compared to 2019 (Table 3.3).

Table 3.3: Australian electricity generation, by fuel type, calendar year 2020

	2020	
	GWh	share (per cent)
Fossil fuels	200,566	75.6
Black coal	108,753	41.0
Brown coal	34,182	12.9
Gas	53,124	20.0
Oil	4,506	1.7
Renewables	64,667	24.4
Hydro	14,807	5.6
Wind	22,607	8.5
Bioenergy	3,410	1.3
Solar PV small scale	15,719	5.9
Solar PV large scale	8,123	3.1
Total	265,232	100.0

Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table O

Fossil fuel sources contributed 201 terawatt hours (76 per cent) of total electricity generation in 2020, down 3 percentage points on 2019. Coal continued to account for the majority of electricity generation, but declined to 54 per cent of total generation in 2020.

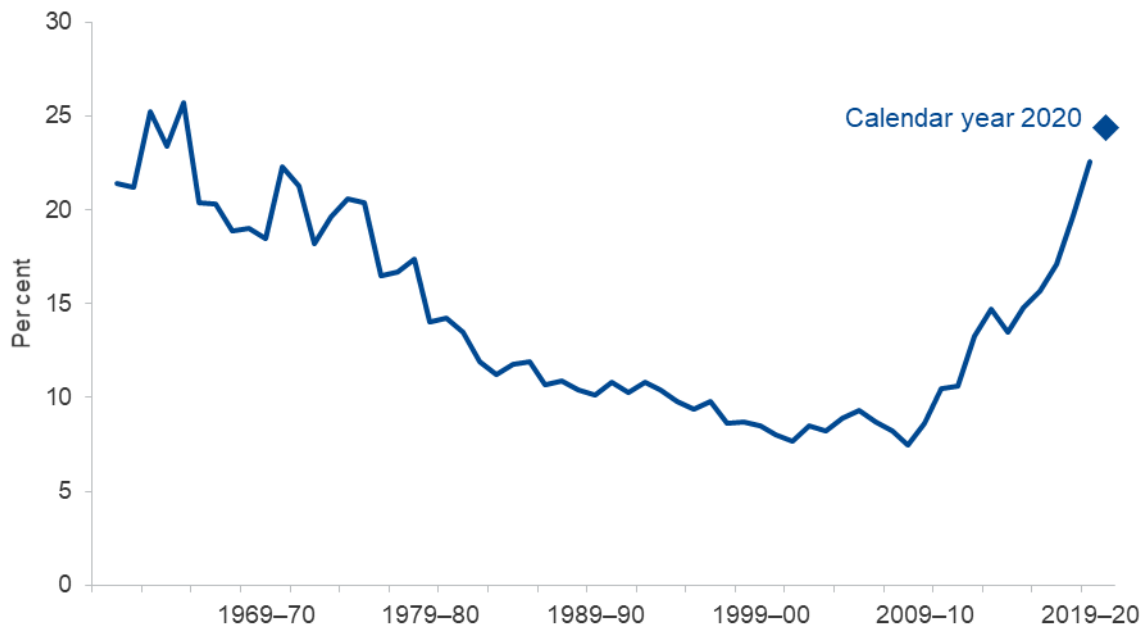
Gas-fired generation in 2020 was 20 per cent of total generation, down 1 percentage point on 2019. This was mostly due to mild weather and increased renewables and brown coal generation in the NEM, despite lower gas prices.

Renewable sources contributed 65 terawatt hours, or about 24 per cent of total electricity generation in 2020. This share was up 3 percentage points on 2019. This represents the highest share of total generation since levels recorded in the mid-1960s as capacity in the Snowy Mountains hydroelectric scheme progressively came online (Figure 3.8).

The largest source of renewable generation in 2020 was solar (9 per cent of total generation), followed by wind (9 per cent) and hydro (6 per cent). In 2020 the steepest increases were in large-scale and small-scale solar generation. Wind and hydro generation also increased.

The growth of large-scale solar in 2020 took it to over one-third of all solar generation, up from just 8 per cent of solar generation in 2016. Generation from large-scale solar grew from a very low base over the four-year period since 2016, to be 3 per cent of all Australian electricity generation in 2020.

Figure 3.8: Australian electricity generation share from renewable sources



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table O; International Energy Agency (2021), *World Energy Balances*

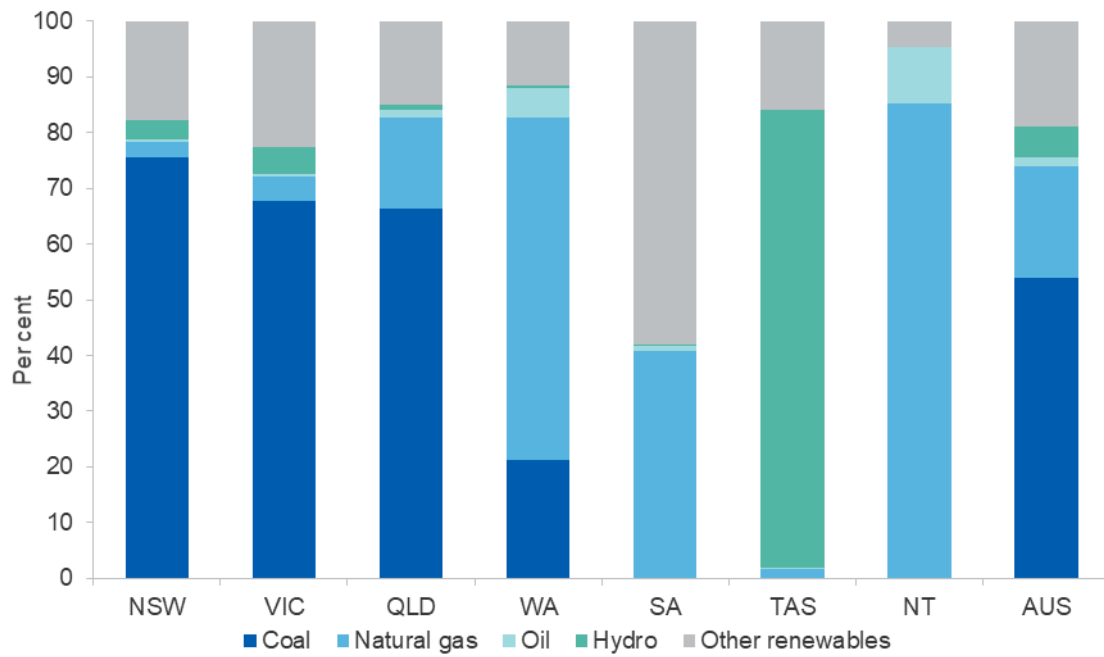
Generation sources vary quite a lot across Australia. In 2020, about three-quarters of electricity generation in New South Wales, and about two-thirds in Queensland and Victoria, was coal-fired (Figure 3.9). In Victoria, brown coal's share was 68 per cent in 2020, down from 83 per cent in 2015 before the closure of the Hazelwood power station in early 2017.

Gas accounted for the majority of generation in Western Australia and the Northern Territory, and just over 40 per cent of South Australian generation. Western Australia accounted for just over half of Australia's gas-fired generation in 2020.

Renewable energy's share of generation in 2020 was 98 per cent in Tasmania and 58 per cent in South Australia. In Tasmania, 82 per cent of all generation was hydro, while in South Australia, wind accounted for 39 per cent of generation and solar another 18 per cent.

Queensland was the leading state for both large and small-scale solar generation totals in 2020. However, overall renewable generation in Queensland was 16 per cent of all generation, lower than the 27 per cent in Victoria and 21 per cent in New South Wales.

Figure 3.9: Australian electricity generation fuel mix, calendar year 2020



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table O

4. Energy trade

4.1 Exports

Australia exports the large majority of its energy production, around 81 per cent in 2019–20. Around 90 per cent of black coal energy production was exported, as was around 74 per cent of domestic natural gas production and 78 per cent of crude oil production. Australia’s energy exports rose by 2 per cent in 2019–20 to reach 16,290 petajoules, supported by an increase in LNG exports (Table 4.1; Figure 4.1).

Table 4.1: Australian energy exports, by fuel type

	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
Black coal	11,061.7	67.9	-0.6	3.6
Coal by-products	26.5	0.2	16.0	na
LNG	4,392.5	27.0	6.4	16.6
Crude oil	625.6	3.8	14.7	-1.6
LPG	141.3	0.9	47.8	8.7
Refined products	42.2	0.3	-10.9	2.2
Total	16,289.8	100.0	2.0	5.6

na – not available

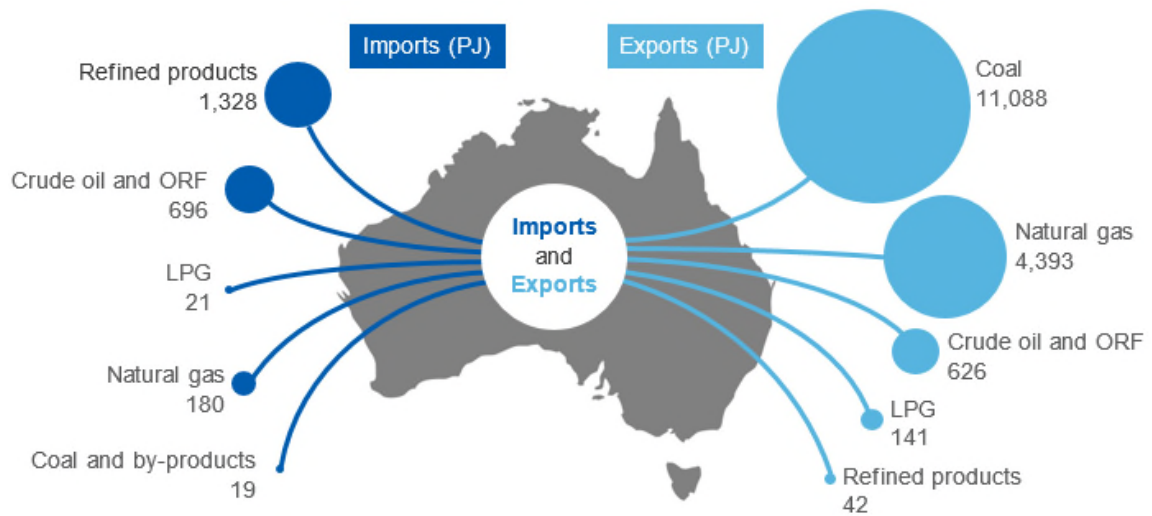
Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table J

Black coal remains Australia’s largest energy export in energy content terms. (Figure 4.2). Exports of black coal fell by 1 per cent in 2019–20 in energy content terms, to 11,062 petajoules (around 390 million tonnes). This mainly reflects a decline in steel making activity in key export markets due to COVID-19 restrictions. On average, coal exports have grown by 4 per cent a year over the past decade.

LNG exports increased by 6 per cent in 2019–20, to 4,393 petajoules (around 79 million tonnes), as new export capacity at Ichthys entered its first full year of operation in the northwest. Exports of LNG have increased by an average of 17 per cent a year over the past decade, with several new facilities commencing production in that period.

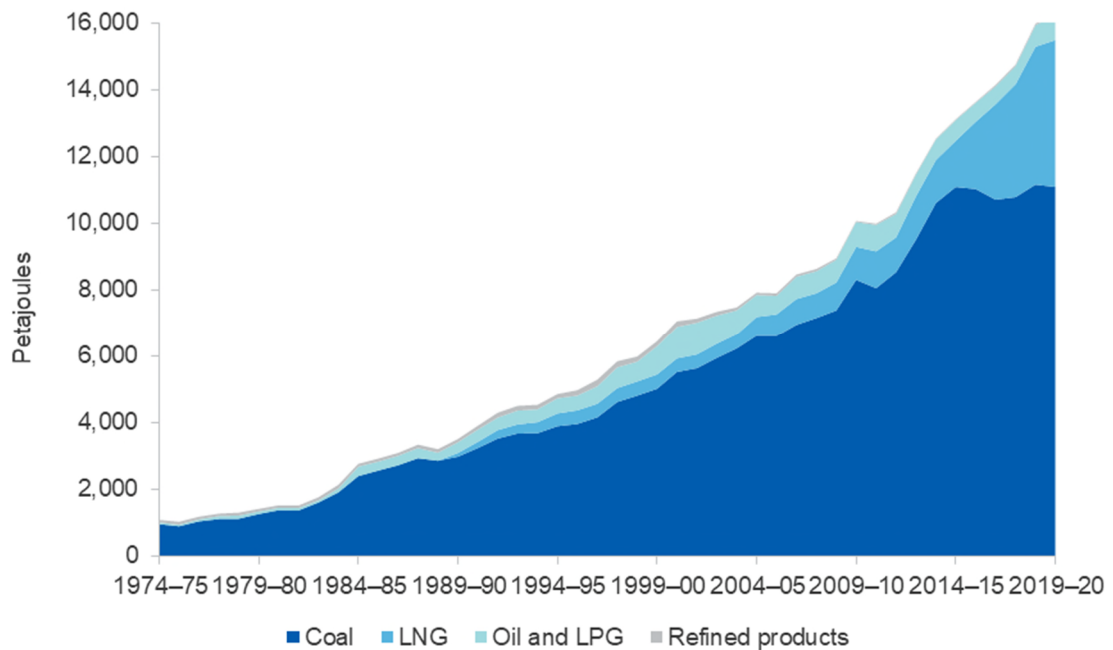
Crude oil exports grew by 15 per cent in 2019–20 to 626 petajoules (17 billion litres). New production in the northwest, particularly of condensate, underpinned this growth.

Figure 4.1: Australian energy trade, 2019–20



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table J

Figure 4.2: Australian energy exports, by fuel type



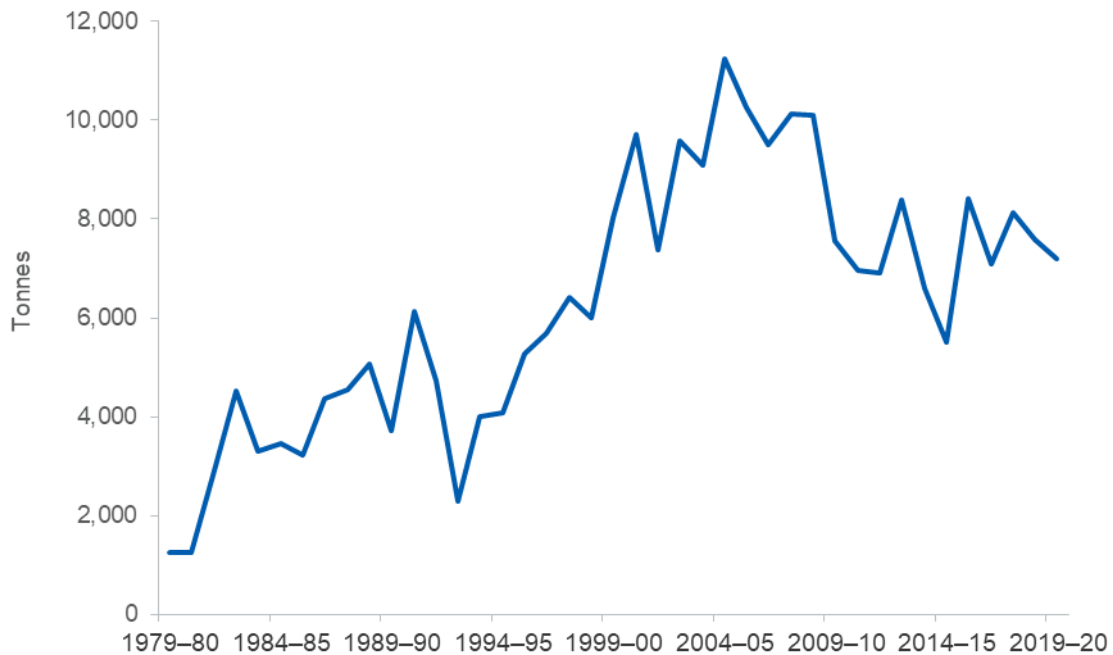
Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table J

Australia exports a small volume of refined products, which declined in 2019–20, although fuel oil and aviation turbine fuel exports rose. Refined product exports remain a relatively small proportion of local production.

Australia also exports large volumes of uranium oxide, which is enriched overseas for use in nuclear power plants. Australia accounted for 14 per cent of world uranium production in 2020 (DISER, 2021d) and is the world’s third largest producer. Uranium is not included in energy production or energy

exports in the *Australian Energy Statistics* because it is not included in a country's energy balance. Instead, the heat content of the steam leaving the nuclear reactor for the turbine is counted, which is not applicable for Australia. Uranium exports decreased by 5 per cent in 2019–20, to 7,195 tonnes (Figure 4.3). While Australia exports all of its uranium production, production and export figures can differ due to stockpiling and shipment timing.

Figure 4.3: Australian uranium exports



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table S

4.2 Imports

Australia's energy imports fell by 7 per cent in 2019–20 to 2,244 petajoules, with declines in most categories of fuel imports (Table 4.2). Refined products and crude oil are by far Australia's largest energy imports (Figure 4.4), with the majority of consumption of these commodities met by imports. Natural gas imports are solely the gas produced in the Joint Petroleum Development Area which is liquefied in Darwin for export.

Imports of crude oil decreased by 17 per cent in 2019–20, to 696 petajoules (around 18 billion litres), reflecting the impact on Australian refineries of reduced demand for refined products for passenger aviation and road transport activity. Imported crude accounted for over two-thirds of total refinery input in 2019–20 (Figure 4.5). Most of Australia's oil production occurs off the north-west coast, far from most domestic refining capacity in major cities.

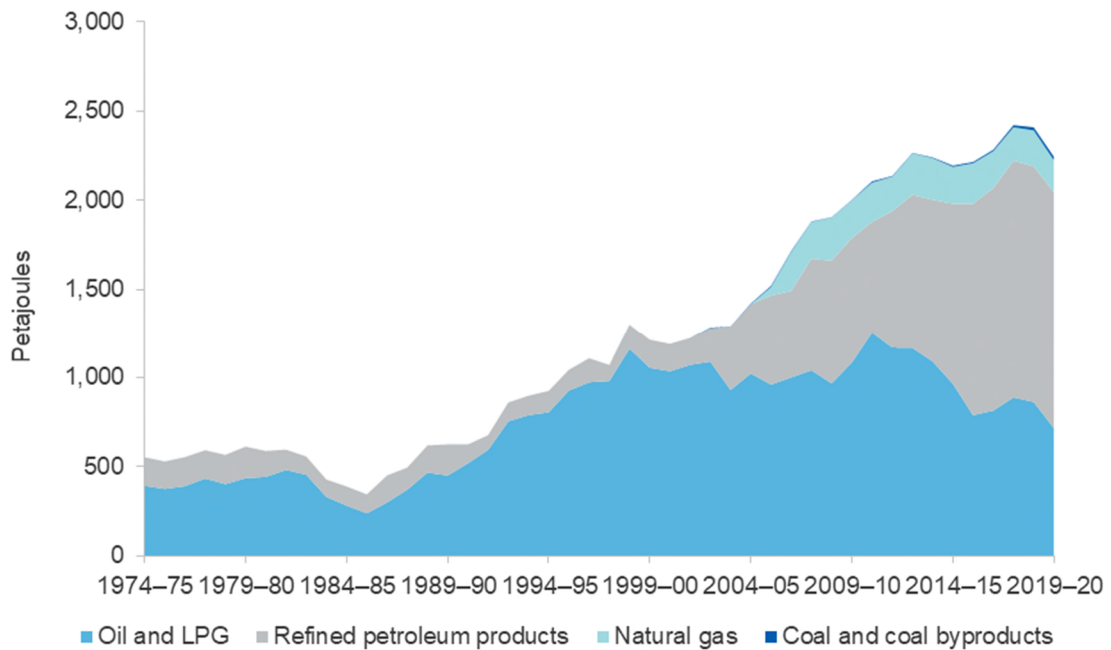
Refined product imports remained relatively static at 1,328 petajoules (around 35 billion litres) in 2019–20. Imported products accounted for around 59 per cent of total refined product consumption (Figure 4.5).

Table 4.2: Australian energy imports, by fuel type

	2019–20		Average annual growth	
	PJ	share (per cent)	2019–20 (per cent)	10 years (per cent)
Crude oil	695.7	31.0	-17.3	-6.1
LPG	20.8	0.9	-3.8	-1.6
Refined products	1,328.4	59.2	0.1	8.8
Natural gas	179.7	8.0	-11.0	-2.3
Coal and coal byproducts	19.2	0.9	11.6	13.1
Total	2,243.8	100.0	-6.9	0.7

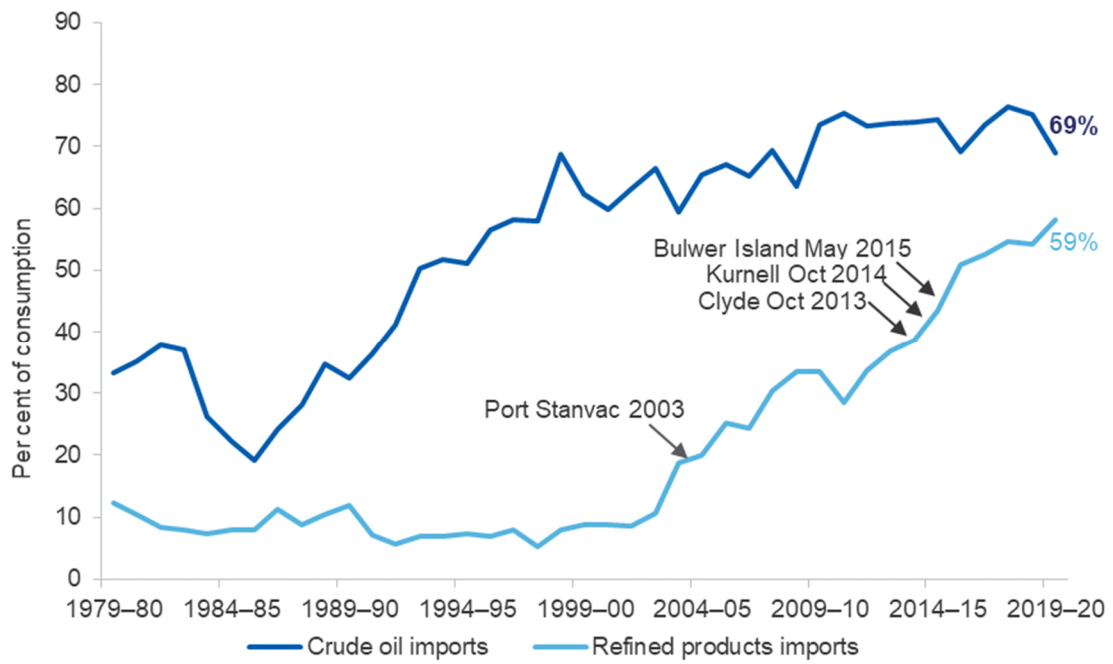
Source: Department of Industry, Science, Energy and Resources (2021) Australian Energy Statistics, Table J

Figure 4.4: Australian energy imports, by fuel type



Source: Department of Industry, Science, Energy and Resources (2021) Australian Energy Statistics, Table J

Figure 4.5: Share of imports in total consumption of crude and refined products



Note: Refinery closures marked by year.

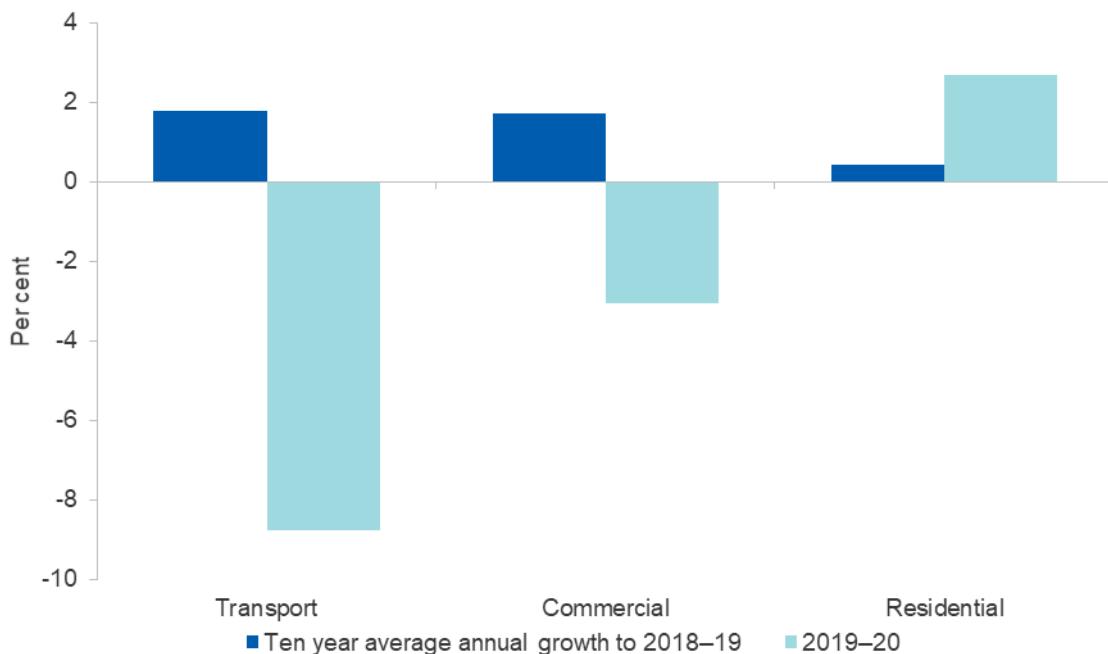
Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Tables D and J

5. COVID-19 impacts on Australian energy consumption

The 2019–20 reference period of this edition of the Australian Energy Statistics covers the first few months of the COVID-19 pandemic’s impact on personal and business activity patterns. Given the close relationship between activity and energy use, the magnitude of the impact was visible in 2019–20. Where monthly and quarterly energy use and activity data are available, these impacts are even more pronounced.

At the sector level, relatively stable long term trends were disrupted in sectors such as transport, residential and commercial, which were most strongly impacted by COVID-19 restrictions and behaviour changes (Figure 5.1). For other sectors like mining, energy use remained relatively unaffected.

Figure 5.1: Ten year average energy consumption growth rates and 2019–20 movement, selected sectors

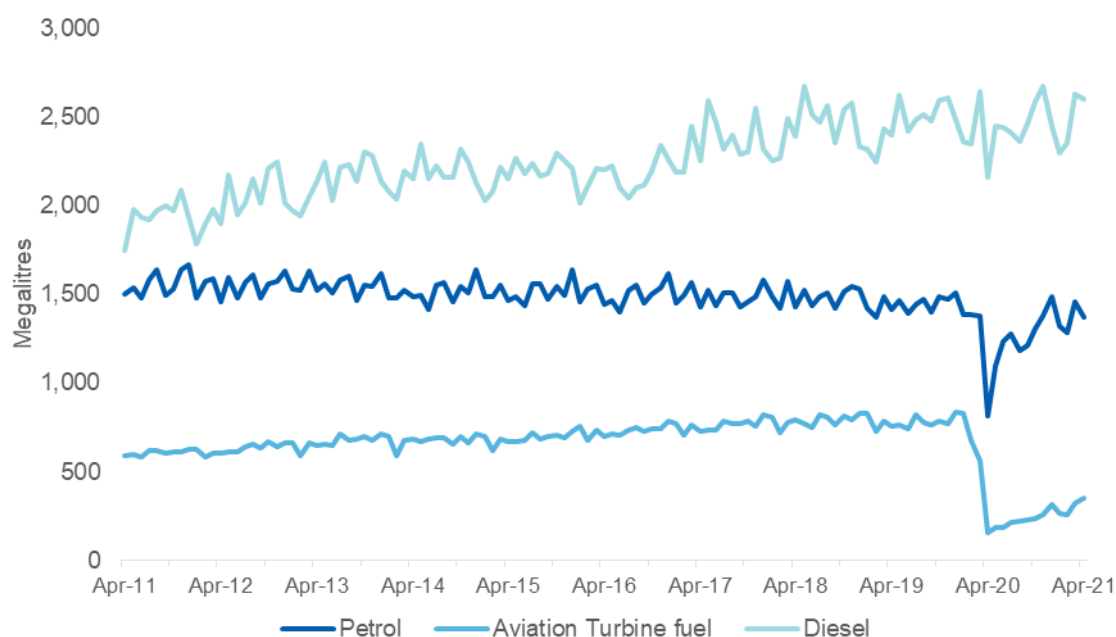


Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table E

5.1 The fall in air and road transport

Annual transport energy use fell by 9 per cent in 2019–20. It was the first time in nearly twenty years that overall transport energy use fell. The transport consumption section of Chapter 2 in this report details transport energy trends for 2019–20 and shows a steep decline in air transport energy use and in petrol use for passenger road transport. Monthly fuel sales data shows the immediate impact of movement restrictions, as well as how these sectors have progressed since the end of June 2020 (Figure 5.2).

Figure 5.2: Sales of refined products, by selected product



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Petroleum Statistics Issue 298 May 2021*, Table 3A

Air transport activity has been severely reduced by the COVID-19 pandemic. Monthly short term visitor and short term resident arrivals each shrank to a few thousand per month in mid-2020, after each peaking above one million per month in the Decembers of the years leading up to 2020 (ABS 2021c).

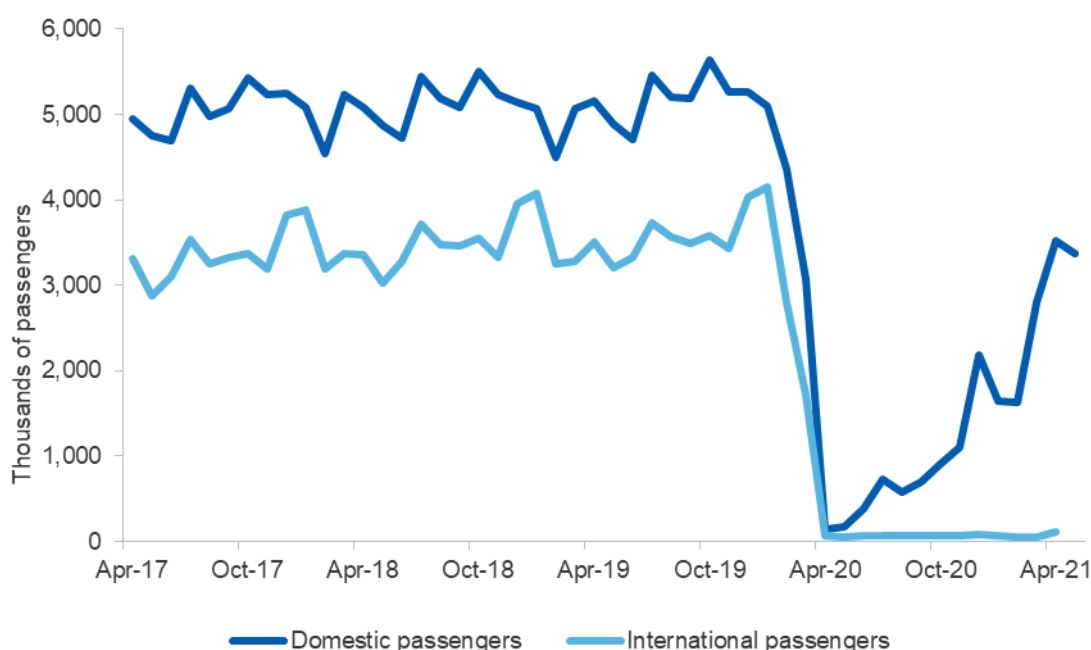
International passenger movements fell by 98 per cent in the twelve months to March 2021 compared to the same time the previous year. Domestic aviation activity levels have also fallen dramatically, with passenger movements in the year ending March 2021 down by 78 per cent on the year ending March 2020 (BITRE 2021).

International aviation activity remains almost entirely suppressed by restrictions, with the 113,000 international passengers (50,000 inbound, 63,000 outbound) constituting just 3 per cent of April 2019 levels (Figure 5.3).

Domestic aviation activity levels into 2021 have started to recover, but are still subject to changes to border restrictions among the states and territories. April 2021 saw the highest level of domestic passenger aviation activity since the pandemic so far, with 3.5 million passengers carried on domestic regular public transport flights, compared to 5.1 million passengers in the corresponding month in 2019 (Figure 5.3).

As a result, the initial decline in air transport fuel use has reversed only modestly. Sales of aviation turbine fuel fell by about 80 per cent year-on-year in April 2020, and by April 2021 had recovered to about 45 per cent of the pre-pandemic April 2019 sales (Figure 5.2).

Figure 5.3: Monthly aviation passenger numbers, domestic and international inbound and outbound



Source: Bureau of Infrastructure and Transport Research Economics (2021) *Aviation Statistics*

Road transport activity in 2019–20 also fell as a result of personal mobility restrictions. Freight activity remained relatively unaffected.

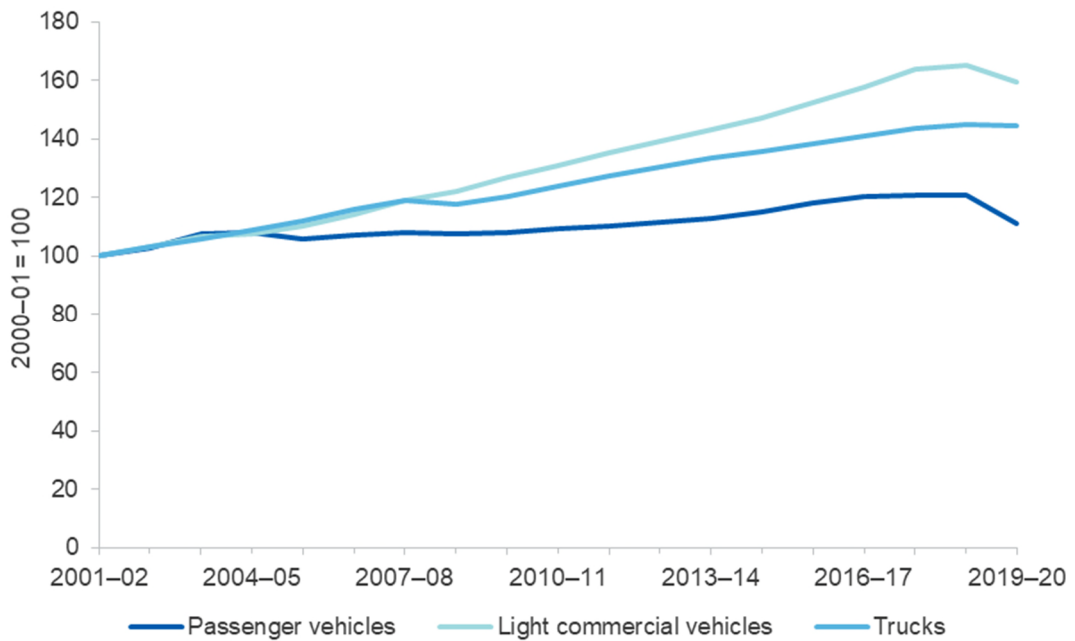
Annual passenger vehicle passenger kilometres fell by 8 per cent in 2019–20, compared with a smaller 3 per cent for light commercial vehicles and essentially flat annual truck kilometres travelled (Figure 5.4). Looking specifically at the period March to June 2020, total passenger vehicle kilometres were down about 30 per cent when compared to July to October 2019 (Figure 5.5). The decline in the period of November 2019 to February 2020 was associated with the Black Summer bushfires across much of the country.

Compared with aviation activity, passenger transport activity has recovered more quickly and completely from the initial stages of the COVID-19 pandemic, after initial national COVID restrictions lifted. By December 2020, petrol sales had effectively returned to their pre-pandemic levels, suggesting passenger road transport activity had returned to relative normalcy by that point.

National and state petrol sales dipped noticeably during periods of major state outbreak restrictions and lockdowns, such as in Victoria in August to October 2020 and again in February 2021 (Figure 5.6).

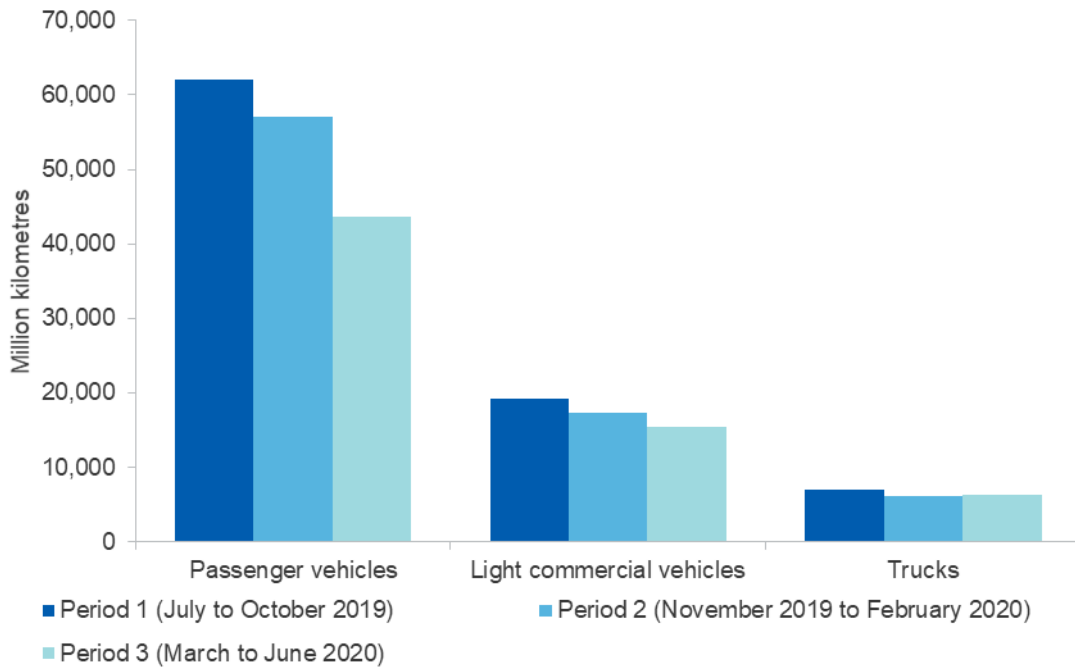
Freight activity levels and truck movements were much less affected by the COVID-19 restrictions (Figures 5.4 and 5.5). Reflecting this, diesel sales remained relatively unaffected over the period. Rather than declining, monthly sales data shows that diesel use increased in March 2020, possibly in response to record growth in retail turnover (Figure 5.2).

Figure 5.4: Index of annual kilometres travelled, selected vehicle types



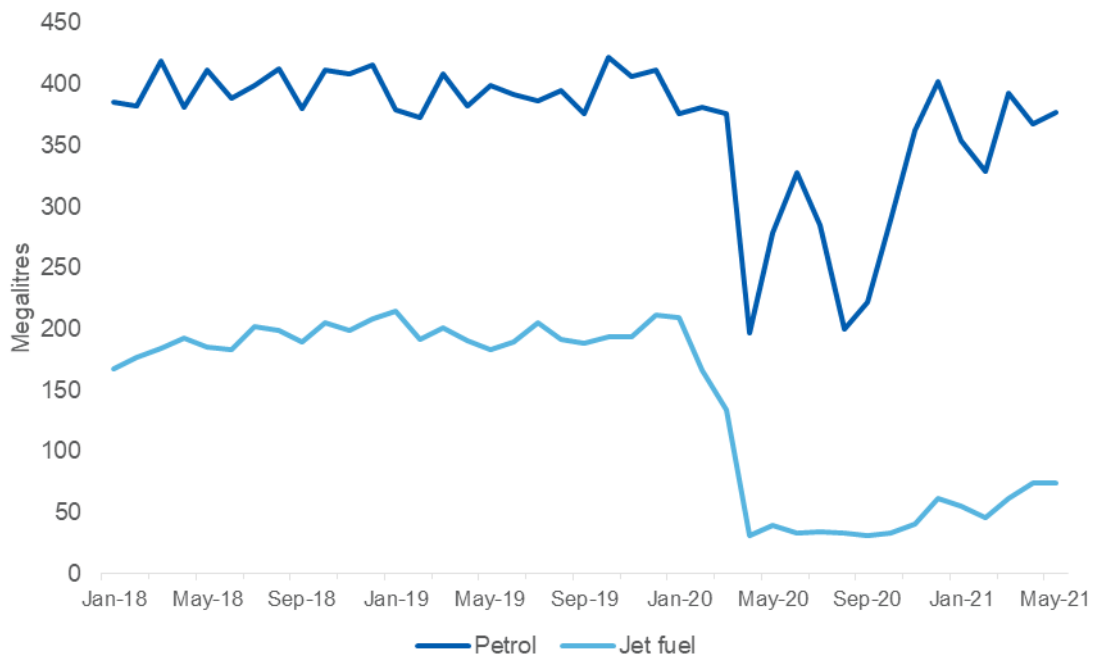
Source: Bureau of Infrastructure and Transport Research Economics (2020) *Australian Infrastructure Statistics—Yearbook 2020*

Figure 5.5: Kilometres travelled, selected vehicle types, four-month periods in 2019–20



Source: Australian Bureau of Statistics (2021) *Sub-annual motor vehicle use estimates, July 2019 to June 2020*

Figure 5.6: Victorian petrol and jet fuel monthly sales



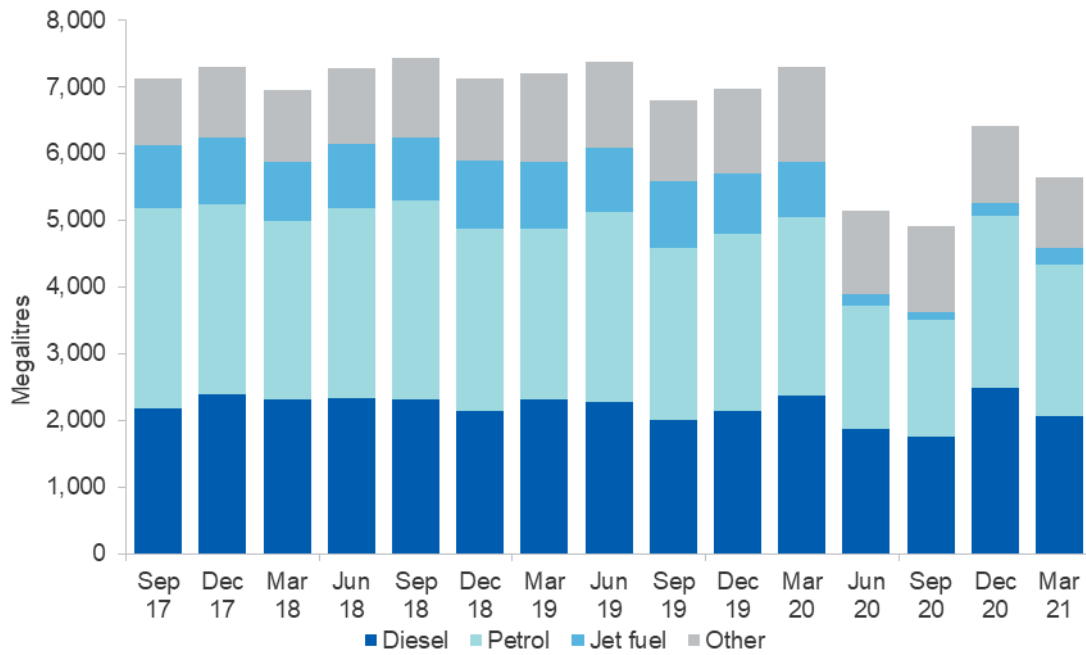
Source: Department of Industry, Science, Energy and Resources (2021) *Australian Petroleum Statistics Issue 298 May 2021*, Table 3B

5.2 Domestic refineries responded with lower production

Domestic refineries responded to lower demand for specific fuel products by cutting production of those products. Diesel production was relatively steady due to the continuing demand by industry, while petrol production fell for several months before rebounding late in 2020. Aviation turbine fuel production at Australian refineries has yet to substantially recover, given the ongoing heavy reductions on aviation activity (Figure 5.7).

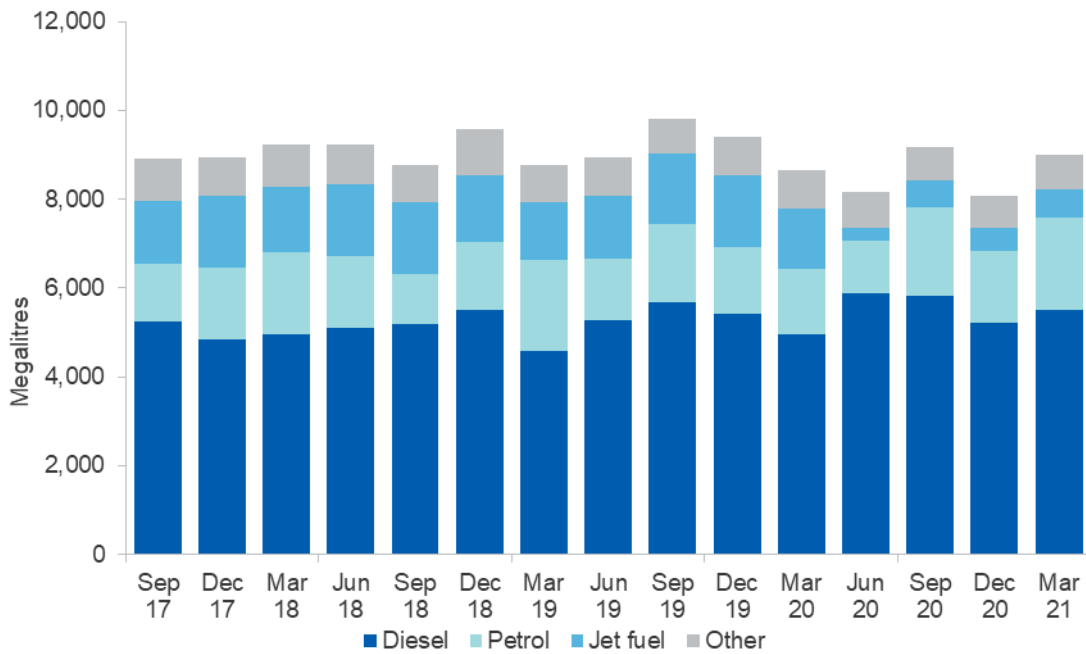
Compared with refinery production, total import levels were relatively unaffected by the demand reductions. However, there were significant differences between products, with diesel imports rising by 18 per cent during the second quarter of 2020, while imports of other refined products fell by 38 per cent, leaving import levels relatively flat from immediately before pandemic restrictions began (Figure 5.8).

Figure 5.7: Quarterly Australian refinery production, by product



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Petroleum Statistics Issue 298 May 2021*, Table 2

Figure 5.8: Quarterly Australian refined product imports, by product



Source: Department of Industry, Science, Energy and Resources (2021) *Australian Petroleum Statistics Issue 298 May 2021*, Table 4

5.3 The commercial to residential sector offset effect

Total residential energy use grew slowly over the last decade, below population growth rates. Improving energy efficiency and changing consumer behaviour reduced individual consumption levels. Per capita household energy use fell by 10 per cent between 2009–10 and 2018–19. The trend reversed in 2019–20 due to reduced personal mobility during COVID-19 restrictions in the final quarter of the year, with more people staying and working from home. Residential energy use grew by 2.7 per cent in 2019–20, and per capita energy use grew by 1.4 per cent.

The Australian Energy Market Operator (AEMO) reported an offsetting effect, with energy use previously seen in workplaces shifting into homes. Only moderate reductions in total electricity use were seen over this period, with year-on-year operational demand reductions in the National Electricity Market of 2.0 per cent and 1.4 per cent in quarters 2 and 3 of 2020 respectively. Such changes are around the same scale as the influence exerted by weather variation from year to year (AEMO 2020).

Workplace activity reductions impacted especially in the commercial and services sector, which includes a wide range of service industries which collectively employed around three quarters of Australian workers in February 2020 (ABS 2021f). These industries include retail and wholesale trade, accommodation, food services, professional and technical services, health and education, government, finance, information and communications technology, and numerous others.

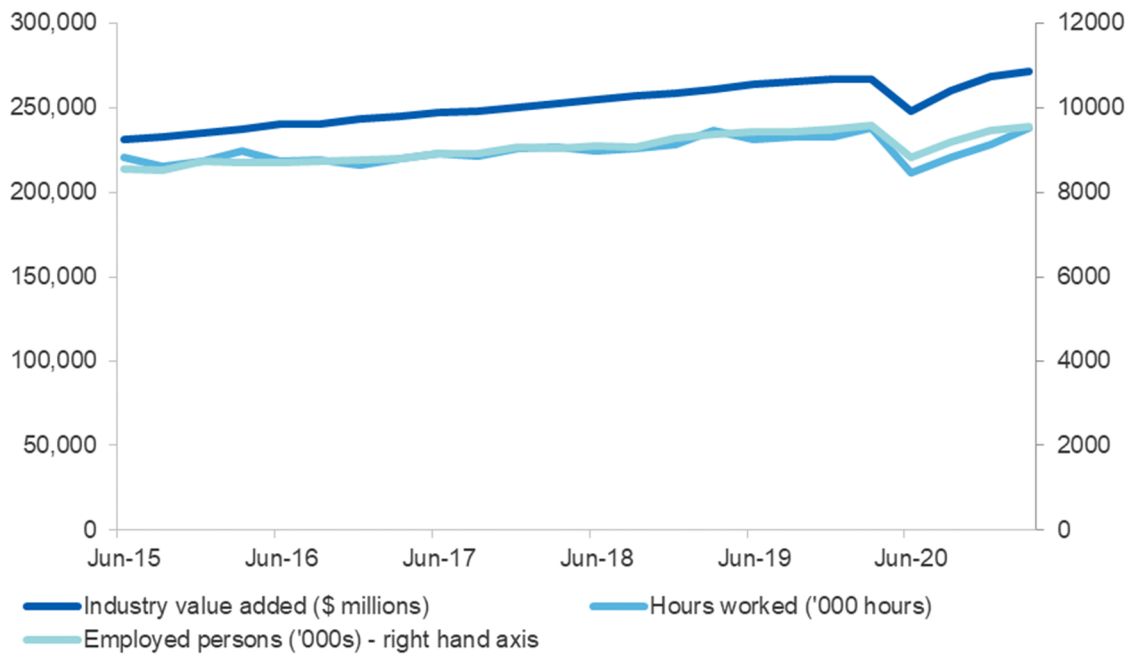
Many of these industries reduced workplace activity by moving to remote working or shutting down for periods, although some others continued unaffected or increased activity in response to the pandemic.

Economic activity in the first COVID-impacted quarter fell substantially for these industries. Industry Value Added was down 7 per cent for the quarter, as was the number of employed persons. Hours worked fell 11 per cent (Figure 5.9).

Overall, the reduced activity at the end of 2019–20 drove a 3.1 per cent decline in annual commercial sector energy activity, which more than entirely offset the 2.7 per cent annual increase in residential energy use (Figure 5.10).

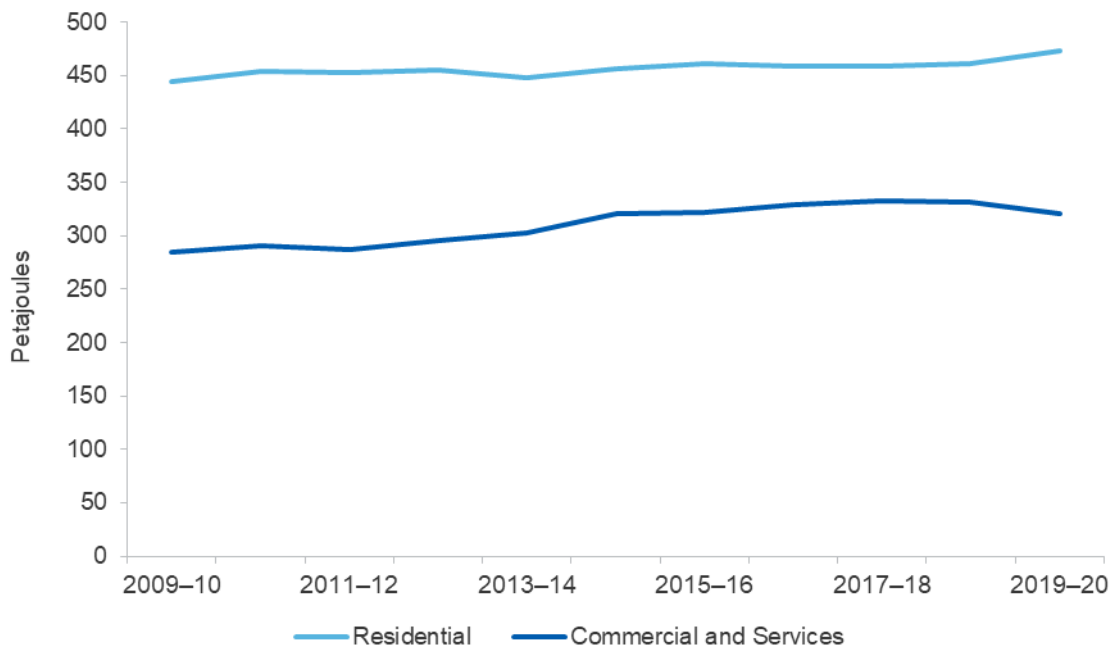
If this shift is assumed to be entirely confined to the last three months of the year, with other factors being equal, this represents movement of well over 10 per cent of commercial sector energy use into the residential sector for the COVID-impacted part of 2019–20.

Figure 5.9: Commercial and services sector industries, quarterly economic indicators



Source: Australian Bureau of Statistics (2021) *Australian National Accounts: National Income, Expenditure and Product*, formerly cat. no. 5206.0 and *Labour Force, Detailed, Australia*, formerly cat. no. 6291.0.55.001

Figure 5.10: Energy use in commercial and services sector and residential sector



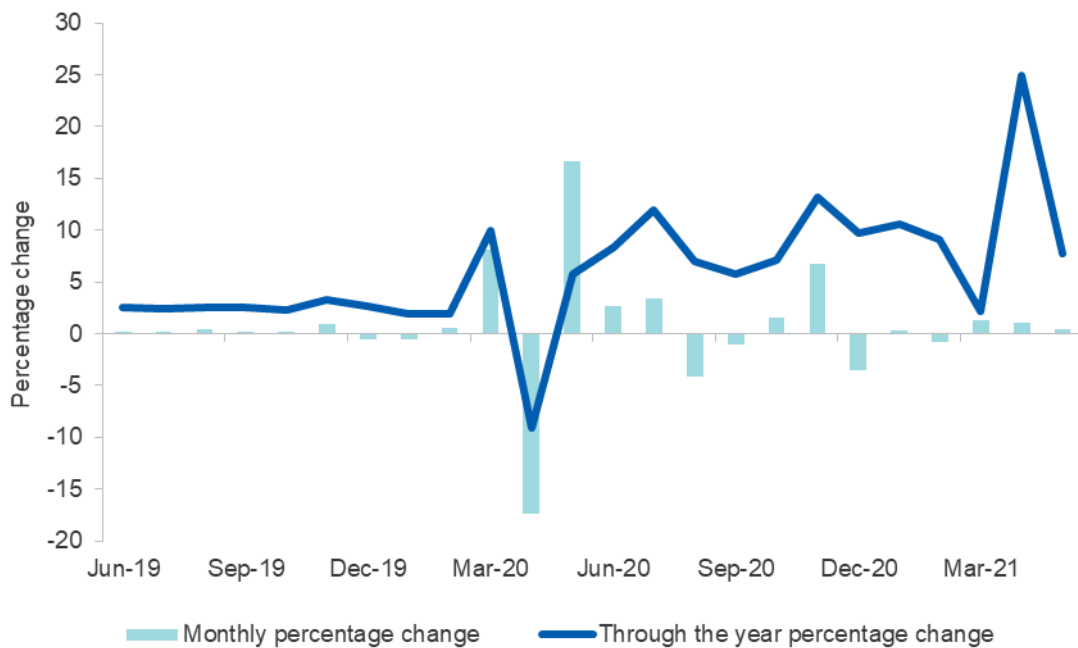
Source: Department of Industry, Science, Energy and Resources (2021) *Australian Energy Statistics*, Table E

Some specific activities within the commercial sector did, however, see an increase in energy use as a result of changed activity patterns. Energy use by Internet service providers and data processing services increased by about 14 per cent in 2019–20, in a combination with long term growth trends and the extra demand for remote working and communicating.

As seen in Figure 5.9, activity in the commercial sector appears to have substantially but not completely rebounded since the second quarter of 2020. Retail turnover saw a record drop during the national April 2020 lockdown (ABS 2021g), but immediately rebounded in May and has grown since (Figure 5.11). Other sectors were slower to rebound fully, but over all Commercial and Services sector Industry Value Added returned to pre-pandemic levels by the last quarter of 2020 and hours worked and employee counts did the same in early 2021.

However, some industries such as accommodation and food services, and arts and recreation, have remained heavily impaired into 2021. The ongoing impact of these structural shifts on energy use remains to be seen.

Figure 5.11: Monthly retail turnover, percentage change



Source: Australian Bureau of Statistics (2021) *Retail Trade, Australia*, formerly cat. no. 8501.0

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