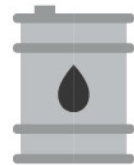


# Oil

Resources and Energy Quarterly March 2019

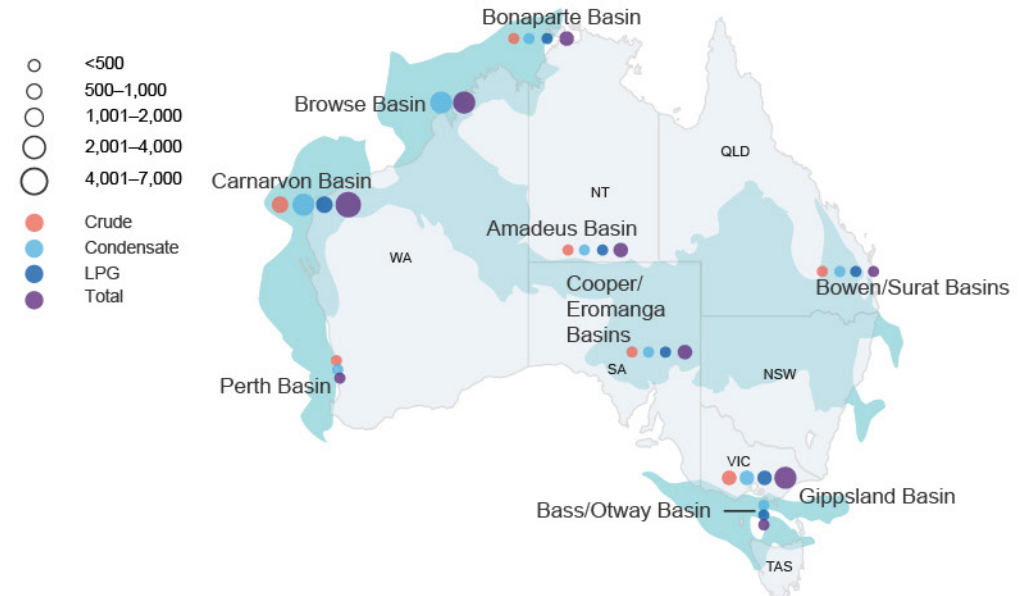


Around **18%** of refinery feedstock is domestically produced, the remainder is imported

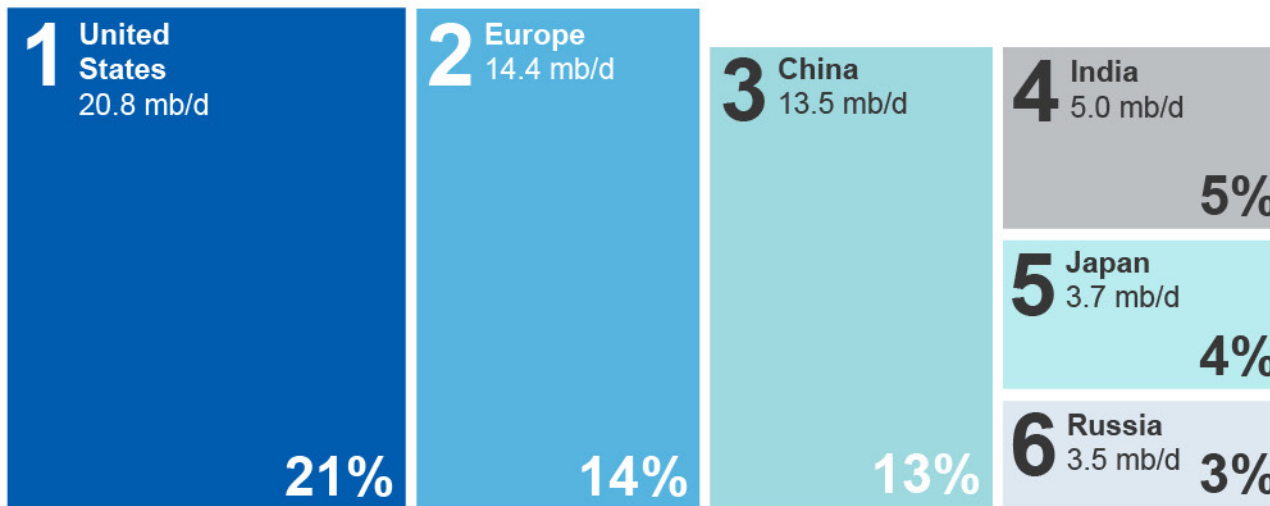


In the last 5 years the Brent spot price ranged from **US\$26 – US\$115** a barrel, and averaged **US\$63** a barrel

## Australia's crude oil, condensate and LPG resources (PJ)

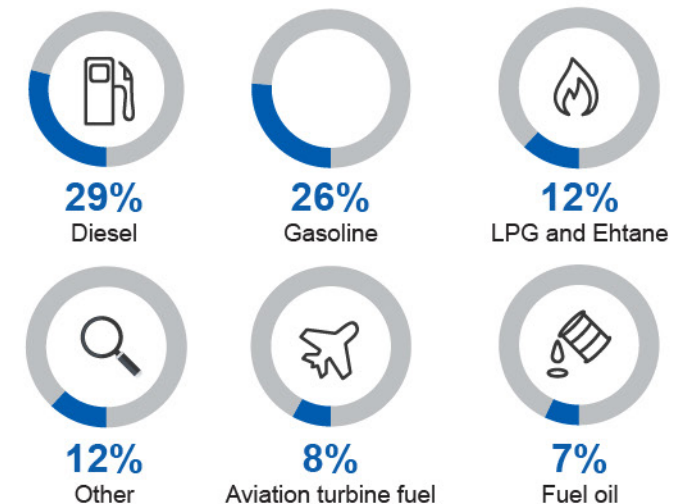


## Key consumer markets of oil products



Note: Measured in million barrels per day.

## World consumption of oil products



## 8.1 Summary

- In 2019, oil prices are expected to average US\$69 a barrel, as OPEC and Russian production declines. Over the medium term, strong growth in US shale oil supply is likely to drive prices lower.
- Australia's oil export volumes are projected to increase — as a side effect of big new LNG projects coming online — and peak in 2020–21.
- Annual real earnings from oil exports are expected to rise from \$7.1 billion in 2017–18 to peak at \$11 billion in 2019–20, before declining to a projected \$7.9 billion in 2023–24.

## 8.2 Prices

### Recent fears of oil shortages addressed by record production

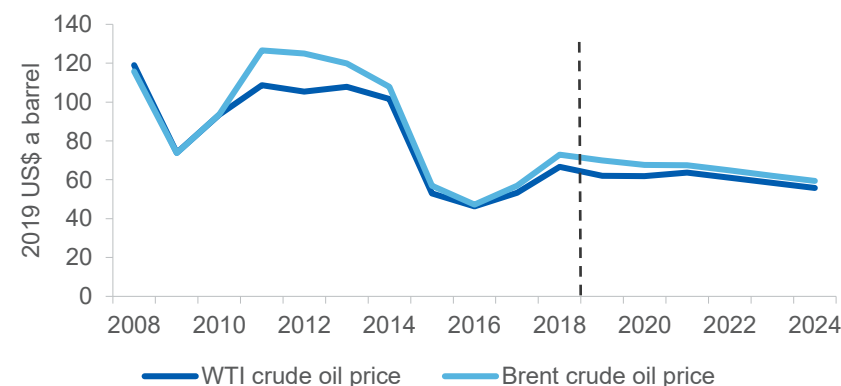
Despite some volatility in oil prices towards the end of 2018, a high average price of US\$73 a barrel for the year contributed to the largest increase in production since 2015. World output in 2018 rose by 2.7 million barrels a day to reach a record level of 100 million barrels a day.

While the Brent spot price fell in the final two months of 2018 — to a low of US\$50 a barrel at the end of December — it has moved steadily upward ever since, peaking at \$68 in late March 2019. This price recovery brings oil markets back into familiar territory, with the year to date average 2019 Brent price being US\$63, consistent with its average of the past two years.

### Medium term outlook for oil spot prices is likely down

In the short term, the renewed production agreement between OPEC, Russia, Kazakhstan, Mexico and seven other countries (collectively referred to as 'OPEC+') is expected to support oil prices averaging US\$69 a barrel in 2019. As of the end of February 2019, Saudi Arabia had reduced production by more than the agreement stipulated.

Figure 8.1 Historical and projected real oil prices



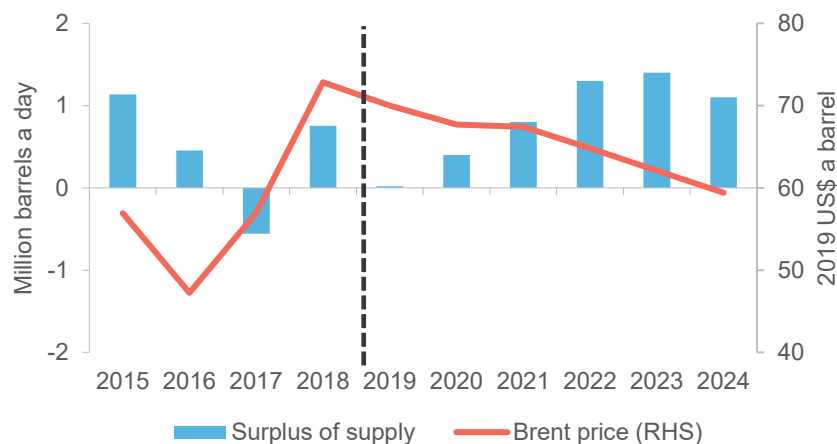
Source: Bloomberg (2019); Department of Industry, Innovation and Science (2019)

US production grew at a record rate to reach a record level in 2018. Global oil and liquid fuel inventories rose in late 2018 — by almost a million barrels a day, as supply exceeded demand through the year.

Excess supply is not expected to continue in 2019, with demand and supply forecast to be more evenly balanced, which should help stabilise prices (Figure 8.2). The main risk in the short term is that prices could spike higher if, due to unplanned outages, supply from Venezuela, Iran or Libya unexpectedly declines. Oil prices could also be lower on weaker consumption growth caused by lower-than-expected economic growth, particularly in China.

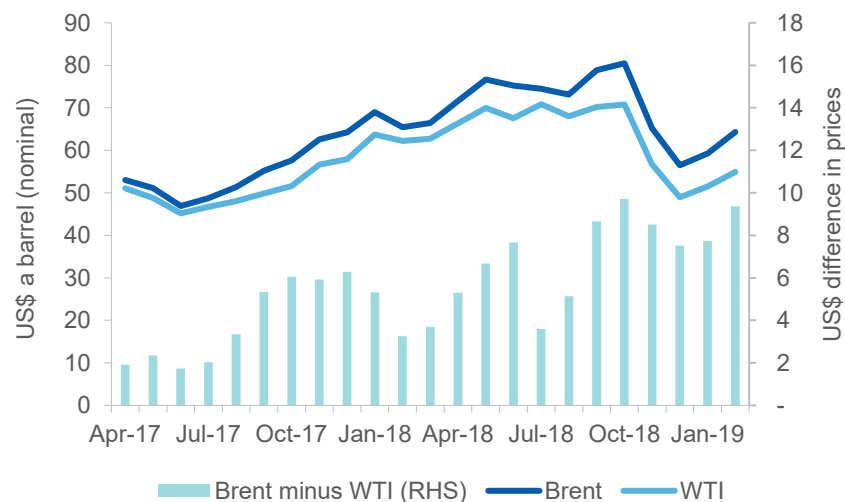
Beyond 2020, oil markets are expected to see excess supply gradually emerge, causing real prices to decline. The Brent crude benchmark spot price is projected to trend down in real terms, from US\$73 a barrel in 2018 to US\$59 a barrel in 2024 (Figure 8.1).

**Figure 8.2: Influence of supply and demand on price**



Source: Bloomberg (2019); Department of Industry, Innovation and Science (2019); International Energy Agency (2019).

**Figure 8.3: US distribution bottlenecks increase benchmark spread**



Source: Bloomberg (2019).

In the medium term, increases in the supply of oil — primarily from the US — supported by rapid technological progress (pushing down marginal production costs) are expected to exceed the growth in demand for oil, so prices are unlikely to be sustained above US\$70 in real terms.

By far the biggest wild card for prices is US production — another year of faster-than-expected growth from US shale oil fields could push prices down sooner. US output growth is a factor behind the existing large discount (up to US\$10) at which the WTI benchmark has recently been trading compared with its Brent counterpart (Figure 8.3 and see Box 8.1).

Improving global economic growth after 2020 or 2021 may help to temporarily slow down the fall in oil prices, but is not expected to increase demand enough to reverse the trend.

### 8.3 World oil consumption

Global consumption is expected to increase at an average annual rate of 1.2 per cent over the outlook period, from 99 million barrels a day in 2018 to 106 million barrels a day in 2024. There are a number of factors weighing on current and medium term consumption: lower economic growth, currency devaluations in consumer countries (pushing up the price of fuel), as well as energy efficiency improvements and fuel switching trends.

#### Oil consumption growth to be driven by Asia and Middle East

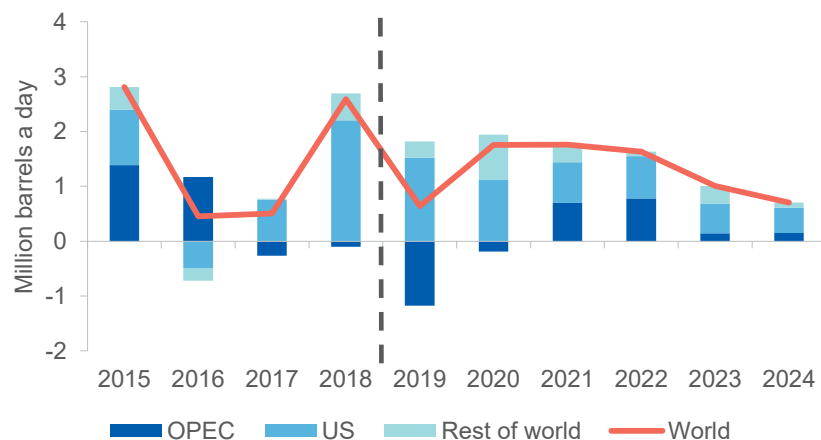
Non-OECD countries are expected to account for all of the growth in oil consumption over the outlook period, with non-OECD consumption projected to reach 58 million barrels a day in 2024, up from 51 million in 2018. Consumption in China alone is expected to reach 15 million barrels a day, increasing at an average annual rate of 2.3 per cent. In India, consumption is projected to increase at an annual rate of 3.9 per cent, reaching 6.0 million barrels a day in 2024. By contrast, OECD consumption is expected to remain steady at 48 million barrels a day over the outlook period, as energy efficiency improves.

While Australia is an OECD country, it is not expected to follow the OECD trend of static consumption. Australia's consumption grew at an annual rate of around 2.2 per cent in the 8 years to 2017-18. In the absence of policy change, it is likely to keep growing at least as fast as the global average of 1.2 per cent, supported by expected ongoing growth in its population and economy.

## 8.4 World oil production

Over the past few years, rampant growth in US shale oil production has pitted against production-limiting efforts by OPEC+. Despite the efforts of OPEC+, oil production is projected to continue to match the growth rate of consumption on average over the outlook period, rising from 100 million barrels a day in 2018 to 108 million barrels a day in 2024.

**Figure 8.4: Annual change in world oil production by region**



Source: International Energy Agency (2019); Department of Industry, Innovation and Science (2019)

In the US, improving oil well efficiency continues to drive this growth, despite some infrastructure capacity constraints. The US is currently the

largest oil producer in the world, and is expected to drive world production growth over the medium-term (Figure 8.4) on the back of a long period of investment in exploration, wells and infrastructure. After growth of 17 per cent in 2018 alone, US production is projected to increase at an average annual rate of 4.8 per cent, to reach 21 million barrels a day in 2024, up from 16 million in 2018.

### Saudi Arabia cuts production and unplanned outages pose a risk

In December 2018, OPEC+ agreed to voluntary production cuts of 1.2 million crude oil barrels a day for the first half of 2019. By the end of February 2019, OPEC+ total oil (crude oil and other refinery feedstocks such as condensate) production was at 54.8 million barrels a day. This level was lower than October 2018 total oil production levels by 1.7 million barrels a day. Voluntary cuts, led by Saudi Arabia and the United Arab Emirates, combined with unplanned outages in Iran, Libya and Venezuela to drive production down. As agreed, Russian cuts are anticipated to occur with the arrival of warmer spring weather in April to avoid damage to equipment.

In the immediate future, the commitment of OPEC+ to cut production, combined with the risk of further unplanned outages in Iran, Libya and Venezuela, could further reduce supply and push up oil prices unexpectedly high for a period.

Iran is the 6th largest producer of oil in the world, producing 4 to 5 percent of global output. Concerns remain about the impact on oil markets of the reintroduction of US sanctions on Iran. The US is allowing a number of countries (including China, India and Korea) to continue importing from Iran for the time being. If those waivers are not renewed in mid-2019, Iran's exports could reduce in 2019, and prices may rise in response.

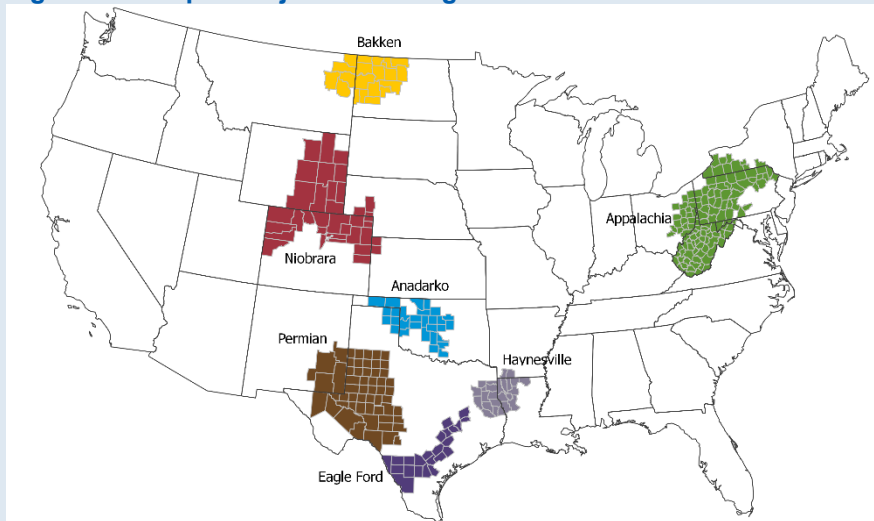
US oil production growth has exceeded expectations in recent years, and may continue to do so, due to its vast investment in shale oil.

### Box 8.1: US shale oil producers hold the wild card

Over the medium term, strong growth in US production will continue to present risks of oversupply in the global oil market. The major US shale oil basins have recently broken records, both in terms of output growth and the absolute amount produced. The US is once again the world's largest oil producer (despite its conventional oil production tapering off since the 1970s) and also the fastest growing major producer.

As recently as 2010, the majority of oil production in the US was what is now termed 'conventional', in which a vertical well is drilled into a naturally-occurring reservoir of oil underground. That changed in the current decade, as shale oil — also known as tight oil — grew to dominate US oil output. Tight oil lies not in a reservoir but embedded in semi-permeable rock and requires horizontal drilling and hydraulic fracturing to access. These technologies and techniques have been rapidly developing over the last two decades, driving down the costs of producing oil from this type of geology.

**Figure 8.5: Map of major US shale gas leases**



Source: US Energy Information Administration (2018).

In 2018, most of the growth in US crude oil output came from shale rock formations within the Permian Basin region in Texas and New Mexico. The Permian is expected to increase its total production by 1.1 million barrels a day to 4.8 million barrels a day by the end of 2020. The Permian will then account for 36 per cent of total US crude oil production. Growth in oil output is also expected in Eagle Ford in south Texas (to 1.4 million barrels a day by the end of 2019), the Bakkan in North Dakota (to 1.5 million barrels a day by the end of 2020), as well as the Niobrara and Anadarko regions (Figure 8.5).

In contrast to many conventional oil producers, such as the members of OPEC, the US shale oil industry is characterised by a large number of wells, with wide variation in the costs of production. This makes predicting the output of the sector difficult, as it depends on the behaviour of well owners in the face of changing global oil prices. The US backlog of oil wells drilled-but-uncompleted reached 8,576 at the end of February 2019. Providing current transport infrastructure bottlenecks are resolved, these wells are ready to produce if prices rise to a point where they become commercially viable.

Distribution bottlenecks have emerged as output has grown faster than transportation infrastructure — such as pipelines — can be built. Distribution bottlenecks are making it more expensive to transport crude oil from production areas — particularly in West Texas and Oklahoma — to refineries and export terminals along the US Gulf Coast. High transport costs, both within the US and between the US and user markets in Asia, have contributed to a rising gap between the WTI benchmark and its Brent counterpart to over US\$9 in early 2019 (see Figure 8.3). Extensive new pipeline capacity is under construction in the region, with take out capacity for an additional 2 million barrels a day expected to come online in 2019 alone. By easing congestion, this infrastructure should help increase prices received by producers, reducing the gap between the WTI benchmark and Brent benchmark to around US\$4 by 2021.



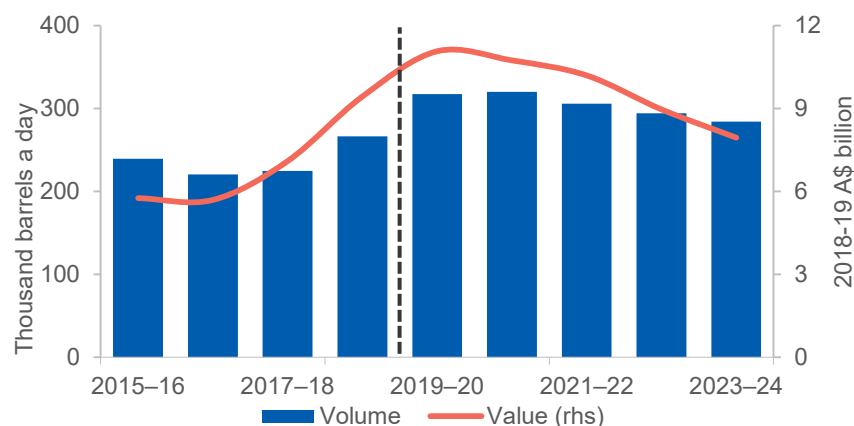
## 8.5 Australia's production and trade

### Export earnings grow strongly on output surge

Quarterly crude and condensate export earnings grew by 70 per cent in the year to the December quarter 2018, to \$2.5 billion. This growth was driven by a large increase in export volumes — up 38 per cent over the period to 277,000 barrels a day — as well as an increase in oil prices and a weaker Australian dollar.

This rapid rate of export growth is not expected to continue over the outlook period, but the absolute level of exports should remain above the levels seen in the December quarter. Annual real (2018–19 dollars) earnings from crude and condensate exports are expected to rise from \$7.1 billion in 2017–18 to peak at \$11.1 billion the following year, but then decline to a projected \$7.9 billion in 2023–24 (Figure 8.6). The projected decline reflects easing production from 2021–22, and falling real oil prices in Australian dollar terms.

**Figure 8.6: Australia's oil export volumes and value – annual**



Notes: Includes crude oil and condensate, but excludes LPG.

Source: ABS (2018); Department of Industry, Innovation and Science (2019).

### Lower crude oil production outweighed by condensate growth

Australia's crude and condensate production in the December quarter 2018 was up 10 per cent over the same period a year earlier. An increase in condensate output more than offset the ongoing decline in crude output. Condensate production has grown 42 per cent since the December quarter 2017, while crude output fell by 24 per cent, with the result that current condensate output is now double crude oil output (Figure 8.7).

Some recent decreases in crude production were temporary. Planned maintenance at BHP's Pyrenees operations lowered production in the September quarter 2018, but is now back online. At Woodside's Vincent and Enfield fields, production has temporarily ceased, in preparation for the Greater Enfield expansion. This project has a nameplate capacity of 40,000 barrels a day, and is expected to come online later in 2019. Greater Enfield is the only expected addition to crude production during the outlook period, and crude production in 2023–24 is projected to be lower than today's modest levels.

Going forward, growing condensate output is expected to drive Australia's petroleum production and export earnings. Production is expected to increase at an average annual rate of 3.5 per cent over the outlook period, from an average 286,000 barrels a day in 2017–18 to average 351,000 barrels a day in 2023–24 (Figure 8.6).

In late 2018, new condensate production came online off the coast of Western Australia in the Browse Basin, with the start-up of Train 1 at the Ichthys facility, operated by INPEX. Ichthys has a nameplate capacity of 100,000 barrels a day of condensate, and in the December quarter it produced around 25 per cent of that capacity. It is expected to increase output steadily through 2019, as Train 2 comes online. Also in the Browse Basin, Shell's Prelude facility commenced operations on 26 December 2018, and shipped its first load of condensate by tanker on 23 March 2019. Prelude's condensate output capacity is expected to reach 36,000 barrels a day.

LPG production is also expected to increase strongly over the outlook period, with extra production from a number of projects related to Ichthys

and Prelude (see section 7.6 in Gas chapter). By 2023–24, Australian LPG output is expected to be 108,000 barrels a day, or 116 per cent higher than its 2017–18 level.

Despite strong growth in the short term, output of condensate and crude is not expected to increase beyond 2020–21, and LPG output should peak in 2021–22, a legacy of declining exploration expenditure (Figure 8.7).

Taking a longer historical perspective, even with the strong volume growth described above, Australian crude oil, condensate and LPG production is expected to peak at around 25 per cent below the level of 2002–03 (Figure 8.7).

#### Exploration expenditure remains low

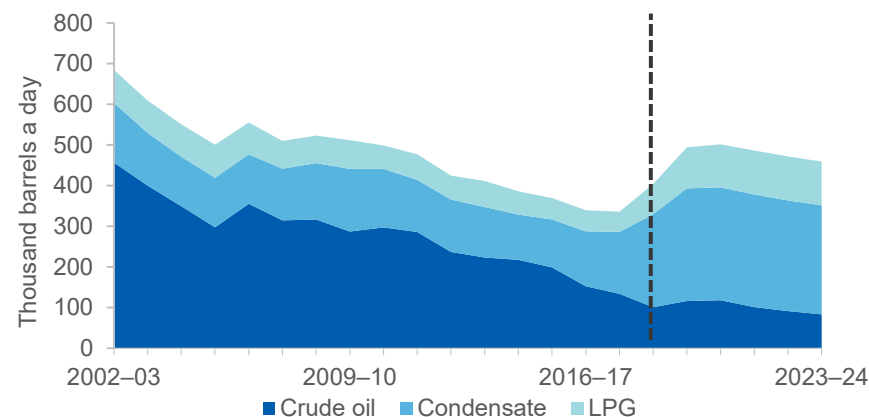
Petroleum exploration expenditure was \$353 million in the December quarter, on a trend basis. On a yearly basis, expenditure in 2018 was the lowest in nominal terms since 2005 and dramatically below the exploration undertaken during the mining investment boom peak (Figure 8.8).

#### Australia's refinery production steady

Australia's refinery production averaged 498,000 barrels a day in calendar year 2018, slightly higher than the 2017 average of 480,000 barrels a day. To meet Australian demand, 60 per cent of refined product was imported from overseas in 2017–18, including around 71 per cent of diesel and 35 per cent of automotive gasoline (Box 8.2).

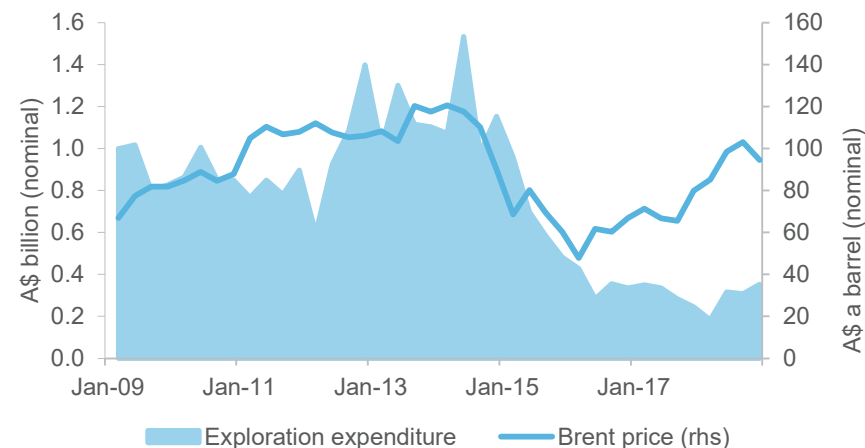
Over the outlook period Australian refinery production is expected to vary with scheduled maintenance and to average around 485,000 barrels a day to 2023–24. With domestic production volumes steady over the outlook period, imports are expected to continue to increase to accommodate projected growth in consumption.

**Figure 8.7: Australia's petroleum production outlook**



Source: EnergyQuest (2019); Australian Petroleum Statistics (2019); Department of Industry, Innovation and Science (2019).

**Figure 8.8: Petroleum exploration expenditure and A\$ oil price**



Source: ABS (2019) Mineral and Petroleum Exploration Expenditure, cat. 8412.0, Bloomberg (2019).

### Box 8.2: Australia: condensate exporter and crude oil importer

In 2018–19 Australia is expected to export 266,000 barrels a day — or 81 per cent — of its crude and condensate production. The largest importers of Australian oil are Indonesia (20 per cent of volume exported) and Singapore (16 per cent).

At the same time, Australian refineries import 83 per cent of the crude oil they process. The largest suppliers by volume are Malaysia (31 per cent of imports), and the United Arab Emirates (17 per cent).

Australia imports over half of the refined petroleum products it consumes (Figure 8.9). The largest suppliers by volume are South Korea (28 per cent of imports) and Singapore (26 per cent).

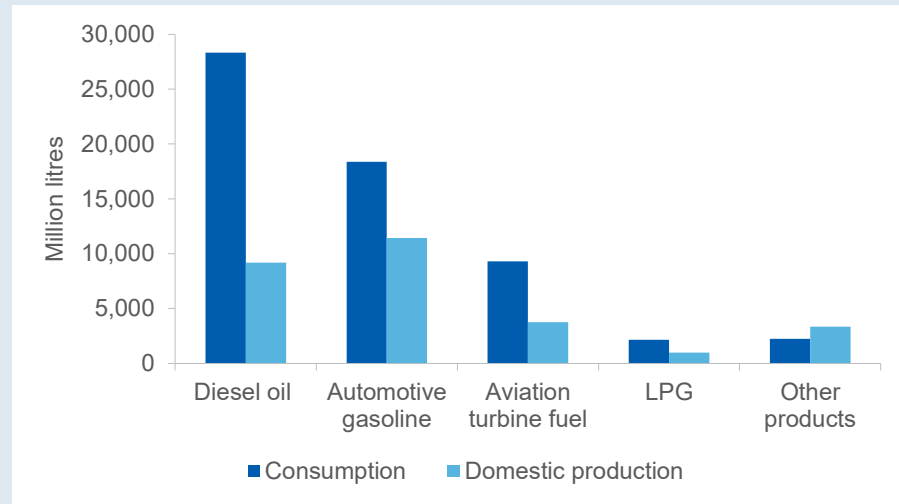
#### *Why does Australia not refine more Australian oil?*

The majority of Australia's petroleum production is exported because the qualities and characteristics of Australian oil are better suited to overseas refineries than the needs of Australian refineries, and because of transport costs.

Most of the current oil production in Australia is in the form of condensates, or natural gas liquids. These oils are light (low density) and sweet (low in sulphur) and do not suit the purposes of Australia's four refineries which were built to use higher-density crude oils. Certain refineries in Asia — especially those producing petrochemicals and gasoline blending — are well suited to use this Australian light sweet condensate as their feedstock, and these refineries pay a premium for it.

Additionally, the bulk of Australia's petroleum production is now located in the north-west of Australia — a whole continent away from the Australia's three east coast refineries. The cost to bring that product to the east coast refineries is no lower than to reach alternative customers in Asia.

Figure 8.9: Consumption and production of refined products 2017–18



Source: Australian Petroleum Statistics (2019).



**Table 8.1: Oil outlook**

World	Unit	2018 <sup>s</sup>	2019 <sup>f</sup>	2020 <sup>f</sup>	2021 <sup>z</sup>	2022 <sup>z</sup>	2023 <sup>z</sup>	2024 <sup>z</sup>	CAGR <sup>r</sup>
Production <sup>a</sup>	mb/d	100.1	100.7	102.4	104.2	105.8	106.8	107.5	1.2
Consumption <sup>a</sup>	mb/d	99.2	100.6	102.0	103.3	104.5	105.4	106.4	1.2
WTI crude oil price									
Nominal	US\$/bbl	65.1	61.3	63.3	66.5	65.3	63.8	62.3	-0.7
Real <sup>b</sup>	US\$/bbl	66.6	61.3	61.8	63.6	61.1	58.4	55.8	-2.9
Brent crude oil price									
Nominal	US\$/bbl	71.2	69.4	69.3	70.5	69.3	67.8	66.3	-1.2
Real <sup>b</sup>	US\$/bbl	72.8	69.4	67.7	67.4	64.8	62.1	59.4	-3.3
Australia	Unit	2017–18	2018–19 <sup>f</sup>	2019–20 <sup>f</sup>	2020–21 <sup>z</sup>	2021–22 <sup>z</sup>	2022–23 <sup>z</sup>	2023–24 <sup>z</sup>	CAGR <sup>r</sup>
<b>Crude and condensate</b>									
Production <sup>a</sup>	kb/d	286	329	393	395	378	363	351	3.5
Export volume <sup>a</sup>	kb/d	225	266	317	320	306	294	284	4.0
Nominal value	A\$m	6,958	9,433	11,335	11,268	10,967	9,889	8,983	4.4
Real value <sup>g</sup>	A\$m	7,097	9,433	11,070	10,740	10,195	8,966	7,944	1.9
Imports <sup>a</sup>	kb/d	386	391	377	375	371	382	378	-0.4
LPG production <sup>ac</sup>	kb/d	50	74	101	106	108	108	108	13.8
<b>Refined products</b>									
Refinery production <sup>a</sup>	kb/d	494	497	485	483	476	484	478	-0.6
Export volume <sup>ad</sup>	kb/d	18	17	17	13	9	9	9	-9.9
Import volume <sup>a</sup>	kb/d	645	659	675	706	745	753	773	3.1
Consumption	kb/d	1,041	1,072	1,091	1,105	1,120	1,135	1,150	1.7

Notes: **a** The number of days in a year is assumed to be 365, and a barrel of oil equals 158.987 litres; **s** Estimate; **f** Forecast; **z** Projection; **b** In 2019 calendar year dollars; **c** Primary products sold as LPG; **d** Excludes LPG; **e** Domestic sales of marketable products; **g** In 2018–19 financial year Australian dollars; **r** Compound average annual growth between 2018 and 2024 or between 2017–18 and 2023–24.

Source: ABS (2019) cat. 5368.0, International Energy Agency (2019), Energy Quest (2019), US Energy Information Administration (2019), Department of Environment and Energy (2019), Department of Industry, Innovation and Science (2019).