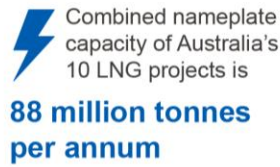
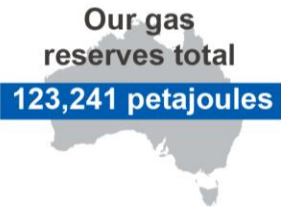
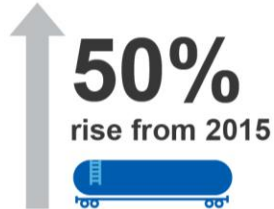
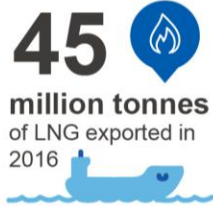


Gas

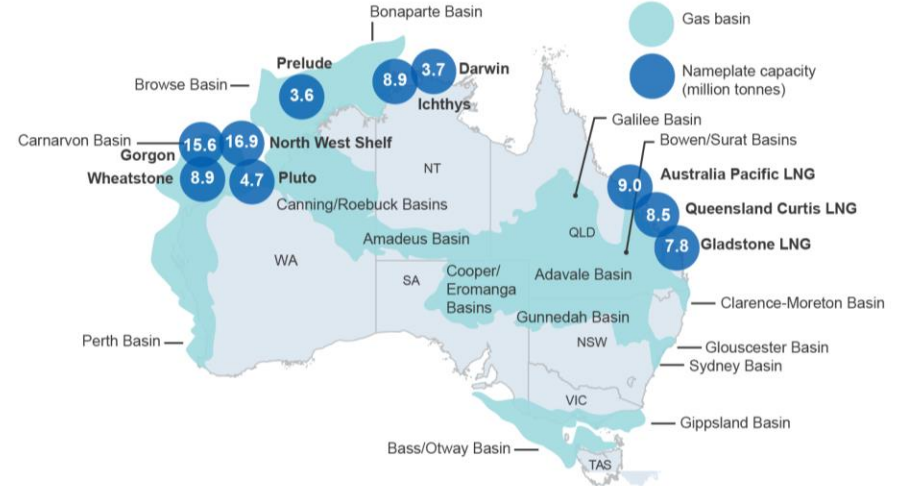
Resources and Energy Quarterly June 2017



largest LNG exporter in the world

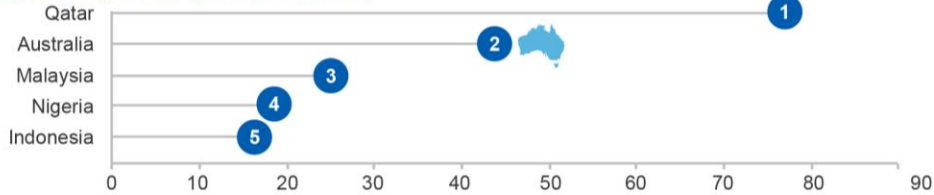


Australia's LNG projects and gas basins

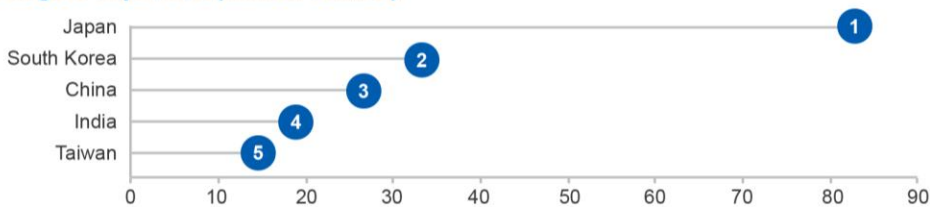


Largest LNG exporters and importers, 2017

Largest exporters (million tonnes)



Largest importers (million tonnes)



Australia's LNG exports



Market summary

The value of Australia's LNG exports is forecast to increase from an estimated \$23 billion in 2016–17 to \$37 billion in 2018–19. Growth in export earnings will be supported by higher export volumes and, to a lesser extent, higher prices. LNG is forecast to overtake metallurgical coal as Australia's second largest resource and energy export in 2018–19.

Estimated export earnings in 2016–17 are \$1 billion lower than forecast in the March *Resources and Energy Quarterly*, with export volumes having been curtailed by several unplanned outages at LNG plants during the first half of 2017. Downward revisions to export earnings in 2017–18 (totalling \$4.0 billion) and 2018–19 (totalling \$1.6 billion) reflect a more subdued outlook for both oil prices (to which LNG prices are directly linked) and export volumes.

Prices

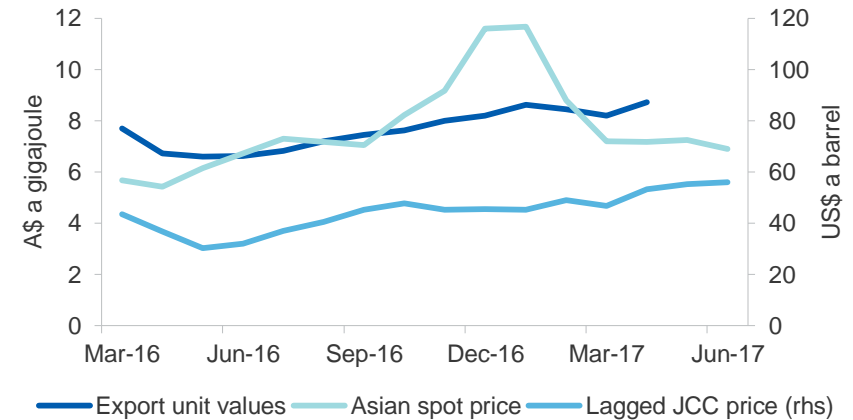
Oil price movements drive Australian LNG prices

The average price of Australian LNG (FOB) reached a one-year high of \$8.70 a gigajoule (GJ) in April — around US\$6.90 per million British thermal units (MMbtu). The increase was supported by the oil price rally in early 2017. The majority of Australian LNG is sold on long-term contracts linked to the price of Japan Customs-cleared Crude (JCC) oil by a time lag of three months.

The average price of Australian LNG (FOB) is forecast to increase to \$9.30 a GJ in 2017–18 (US\$7.30 per MMBtu), before steadying in 2018–19, largely driven by movements in oil-linked contract prices.

However, low spot prices will play some role in constraining the average export price achieved, particularly in 2018–19, as Australian exporters increase their share of sales at spot prices. Asian spot prices (Delivered Ex Ship) are forecast to bottom out at around \$6.10 a GJ in 2019 (around US\$4.70 per MMBtu), as additions to global supply capacity outstrip growth in LNG demand.

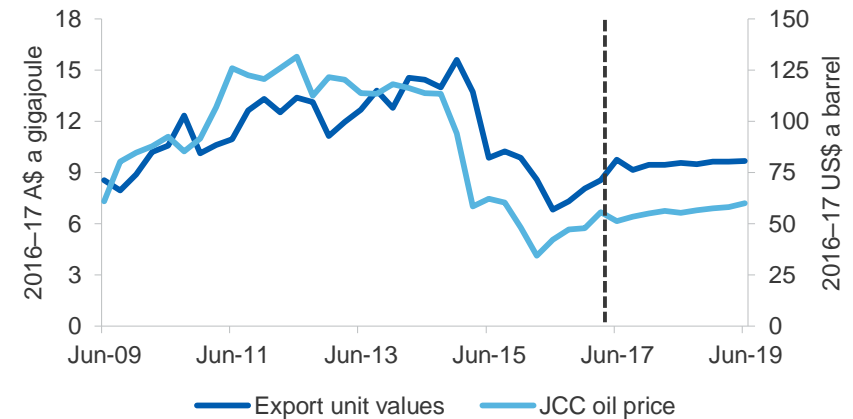
Figure 7.1: Recent movement in export unit values



Notes: JCC price is lagged three months. Spot price index covers Japan, China, South Korea and Taiwan and is for delivery in 4–6 weeks.

Source: ABS (2017); Argus Media (2017); Bloomberg (2017)

Figure 7.2: Export unit value and JCC oil price forecasts



Source: ABS (2017); Argus Media (2017); Bloomberg (2017)

World trade

World LNG trade is forecast to increase at an average annual rate of 7.4 per cent a year, to reach 320 million tonnes in 2019. Emerging Asia — led by China — and Europe are expected to drive demand growth.

Prospects for growth in the imports of the world's two largest consumers — Japan and South Korea — are more limited.

While LNG demand is forecast to grow rapidly over the next few years, it is expected to be outpaced by growth in supply capacity. Consequently, the average capacity utilisation of LNG plants is expected to fall.

World imports

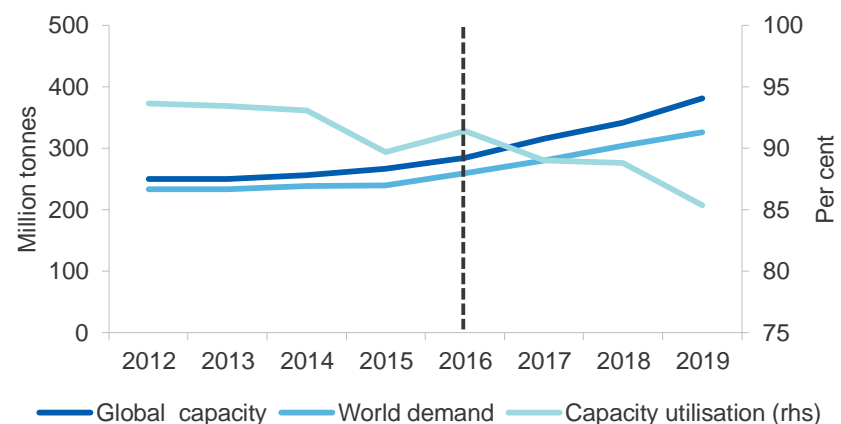
The imports of the world's largest LNG buyer are set to decline

Japan's LNG imports increased by 5 per cent year-on-year in the first four months of 2017, with gas consumption supported by a cold winter across North East Asia. However, the increase in LNG imports is expected to be temporary, with Japan's LNG imports forecast to fall from 83 million tonnes in 2016 to 78 million tonnes in 2019.

The recent restart of nuclear power generation capacity — which competes with gas-fired power — is expected to weigh on LNG imports from mid-2017. Japanese utility Kansai Electric Power reactivated its Takahama No.3 and No.4 reactors in the June quarter (combined capacity 1.7 gigawatts), after a local court injunction was overturned by the High Court in Osaka. Five of Japan's fleet of 42 reactors are now operational, increasing total nuclear capacity from 2.7 gigawatts to 4.4 gigawatts.

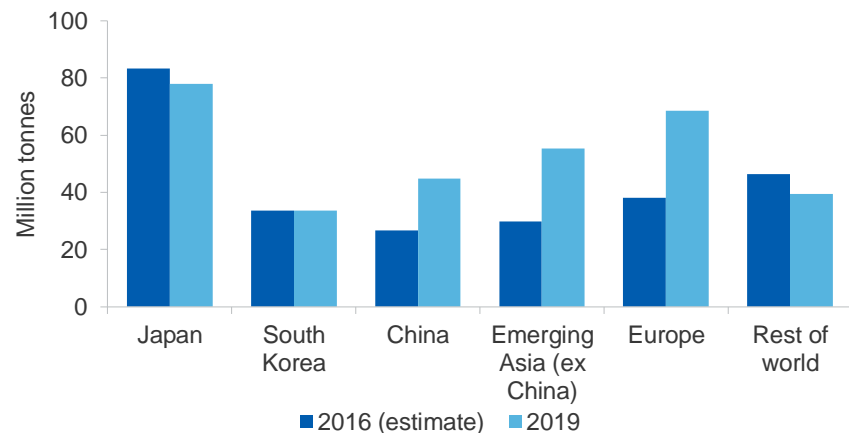
Further reactor restarts are possible within the outlook period. Four more reactors — with capacity totalling 4.7 gigawatts — have received approval from Japan's Nuclear Regulation Authority to restart. However, the timing and scale of nuclear restarts remains a key uncertainty affecting the outlook.

Figure 7.3: Global liquefaction capacity and LNG demand



Source: Nexant World Gas Model (2017); Department of Industry, Innovation and Science (2017)

Figure 7.4: LNG import forecasts



Source: Nexant World Gas Model (2017); Department of Industry, Innovation and Science (2017)

Recent announcements in South Korea could support LNG imports

South Korea's LNG imports are forecast to be broadly unchanged over the outlook period — a small upward revision to the March *Resources and Energy Quarterly* forecast. The new South Korean President, Moon Jae-In, has announced several measures that could provide some support to LNG imports over the next few years.

LNG competes with both nuclear and coal in electricity generation in South Korea. From 2018, operations at six old coal-fired power stations will be suspended between March and June each year, to address worsening air pollution. In addition, two old coal-fired power stations will begin the process of shutting down operations from July 2017, and will close by the end of the year. A further eight coal-fired power closures are expected before mid-2022 (brought forward from 2025), although it is not yet clear when these shutdowns will occur. The South Korean government has also signalled that increases in the consumption tax on coal are likely.

The president has also pledged to close down the aged Wolsong 1 nuclear reactor, to address public concerns about nuclear safety, although a timeline for this has not been specified. The reactor accounts for 2.8 per cent (0.7 gigawatts) of South Korea's nuclear capacity. If gas-fired generation replaces reduced coal-fired and nuclear power capacity, increased LNG imports will be required.

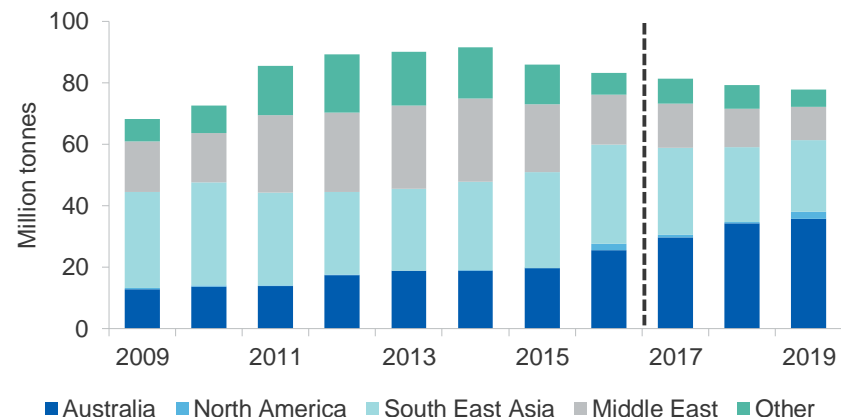
Emerging Asia, led by China, to drive growth in LNG demand

China's LNG imports increased by 39 per cent year-on-year in the first four months of 2017. Gas consumption and domestic production rose, while pipeline imports contracted.

China's LNG imports are forecast to increase from 27 million tonnes in 2016 to 45 million tonnes in 2019 — an average annual rise of 19 per cent. China has agreed to large contracts for LNG imports, which will start over the next few years, in order to meet rising gas demand. The Chinese government is aiming to increase the share of gas in the energy mix from 5 per cent in 2014 to 10 per cent by 2020.

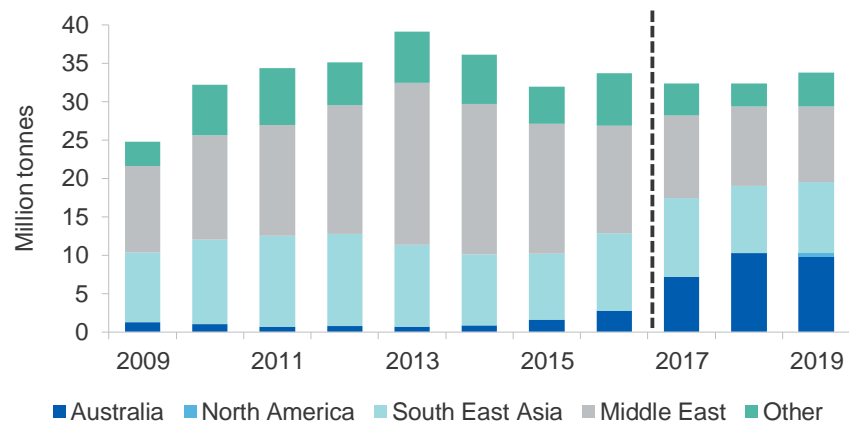
The extent to which China relies on LNG to meet its growing gas needs, however, will depend on whether domestic gas production targets can be achieved, and on LNG's competitiveness vis-à-vis pipeline gas imports.

Figure 7.5: Japan's LNG imports



Source: Nexant World Gas Model (2017); Department of Industry, Innovation and Science (2017)

Figure 7.6: South Korea's LNG imports



Source: Nexant World Gas Model (2017); Department of Industry, Innovation and Science (2017)

Other Emerging Asian economies are also expected to make a large contribution to growth in global LNG imports. Growth will be underpinned by low spot prices and the availability of floating storage and regasification unit (FSRU) technology, which allows small volumes of LNG to be received more cheaply. Pakistan, for example, will commission its second FSRU in late 2017, and a further two FSRUs by 2019.

Europe's LNG imports are expected to increase

European LNG imports are forecast to increase from 38 million tonnes in 2016 to 69 million tonnes in 2019. Rising gas consumption, falling indigenous production (particularly in the Netherlands), and a desire to diversify away from Russian pipeline supply are all expected to support LNG imports. However, if LNG demand in Europe does not grow as strongly as projected, Qatari and US LNG may be displaced, potentially then bringing increased competition to the Asia-Pacific.

World supply

Global supply capacity to rise

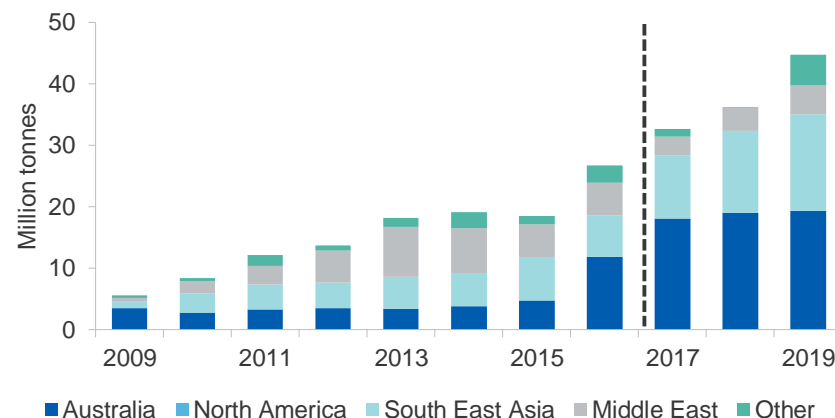
The next few years are expected to see a major expansion in global supply capacity. Global liquefaction capacity is forecast to increase from 285 million tonnes in 2016 to 382 million tonnes in 2019.

The United States will make the largest contribution to new capacity

Around half of all new capacity will come from the United States. By 2019, all five LNG projects currently under construction in the United States are expected to have commenced operations, bringing nameplate capacity to around 64 million tonnes. However, US exports are only forecast to rise to around 37 million tonnes in 2019, with all of these projects scheduled for completion late in the outlook period.

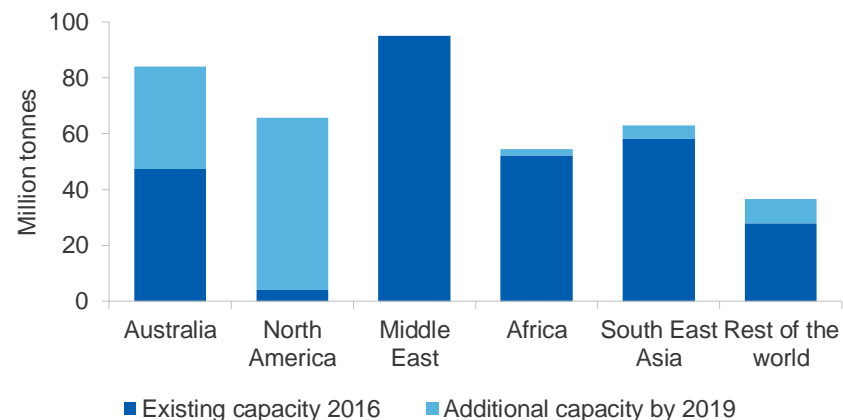
The cost competitiveness of US LNG exporters will largely be determined by the price for which they can purchase domestic gas for export. The US Energy Information Administration forecasts the Henry Hub spot price — the reference price for US domestic gas — to rise from an average US\$2.50 per MMBtu in 2016 (A\$3.20 a GJ) to US\$3.40 per MMBtu in 2018 (A\$4.30 a GJ) because of growing domestic consumption and new export capabilities.

Figure 7.7: China's LNG imports



Source: Nexant World Gas Model (2017); Department of Industry, Innovation and Science (2017)

Figure 7.8: Global LNG supply capacity



Notes: Liquefaction capacity is nameplate capacity less allowance for downtime and maintenance.

Source: Nexant World Gas Model (2017); Department of Industry, Innovation and Science (2017)

Qatar's exports are forecast to remain largely unchanged

Qatar is the world's largest LNG exporter. In 2016, Qatar exported an estimated 77 million tonnes of LNG — the equal highest level since 2011. Qatar's LNG projects have the lowest short-run marginal production costs in the world, and Qatar's exports are forecast to be broadly stable over the outlook period at 74 million tonnes.

To date, Qatar's LNG exports have been largely unaffected by recent tensions with its Middle Eastern neighbours. However, Qatar now reportedly faces higher shipping costs, as a result of the closure of the Port of Fujairah in the United Arab Emirates to Qatari LNG tankers — a key refuelling stop for vessels transiting through the Persian Gulf.

Qatar's decision in April to lift the moratorium on new gas development at its North Field, and potentially expand the capacity of its LNG trains, is not expected to affect its LNG exports within the two-year outlook period.

Australia

LNG export earnings to increase, driven by higher export volumes

The value of Australia's LNG exports is forecast to increase from an estimated \$23 billion in 2016–17 to \$37 billion in 2018–19 — an average annual increase of 28 per cent. Rising export values will be underpinned by higher export volumes and, to a lesser extent, higher prices.

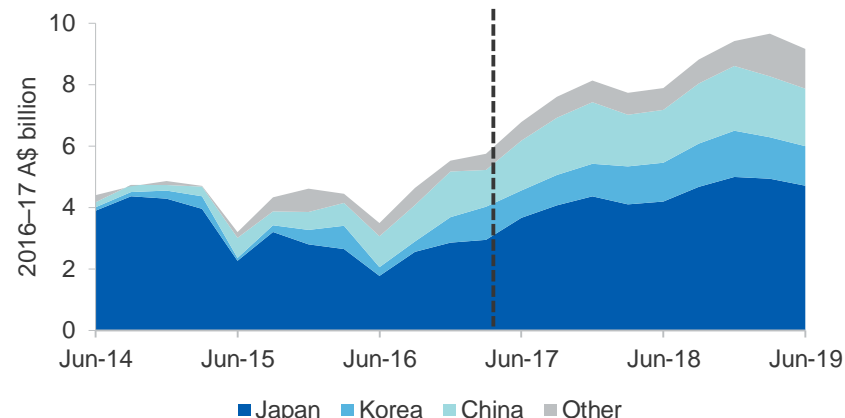
Australia's LNG export volumes are forecast to reach 74 million tonnes in 2018–19, up from an estimated 51 million tonnes in 2016–17. Higher export volumes will be underpinned by the ramp-up of production at Gorgon, as well as the completion of the three remaining LNG projects under construction — Wheatstone, Ichthys and Prelude. These three projects will add around 21 million tonnes to Australia's LNG export capacity, bringing total nameplate capacity to around 88 million tonnes.

The average price of Australian LNG (FOB) is forecast to increase by 12 per cent in 2017–18, before stabilising in 2018–19.

The forecast for export values has been revised down

Estimated export values for 2016–17 are around A\$1 billion lower than forecast in the March *Resources and Energy Quarterly* because of lower than expected exports over the first half of 2017. Production at Woodside's North West Shelf and Pluto projects were affected by

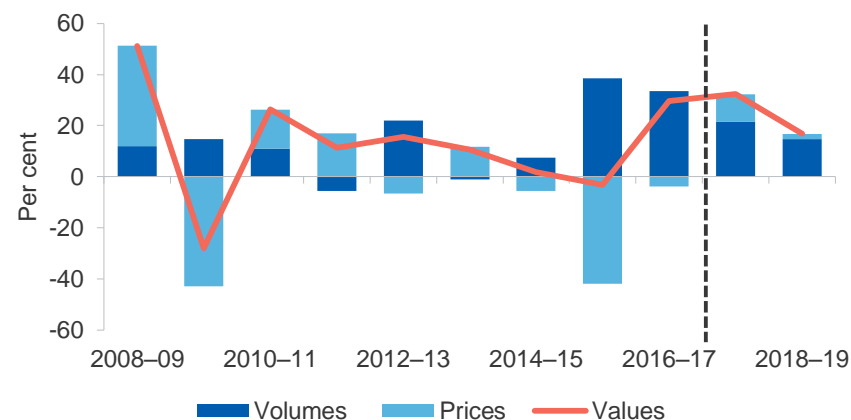
Figure 7.9: Value of Australian LNG exports



Notes: Office of the Chief Economist estimates for historical export values by country based on Argus Media data.

Source: Argus Media (2017); Department of Industry, Innovation and Science (2017)

Figure 7.10: Annual growth in Australia's LNG export values, contributions from prices and export volumes



Notes: Log change is used to approximate percentage change. The approximation becomes less accurate the larger the percentage change.

Source: ABS (2017); Department of Industry, Innovation and Science (2017)

adverse weather conditions in the March quarter. Operations were also suspended at the North West Shelf between 15 and 28 April, following an electrical fault. Train 1 at the Gorgon project was stopped in the second half of May, due to the failure of a flow measurement device. Downward revisions to export values in 2017–18 and 2018–19 (totalling A\$5.6 billion) reflect a more subdued outlook for oil prices, and a slower ramp-up in exports than forecast in the March *Resources and Energy Quarterly*. LNG production at Inpex’s Icthus project — which was originally scheduled to begin in late 2017 — has been delayed until March 2018. More minor revisions have been made to the forecasts for a number of other LNG projects.

A number of uncertainties remain

Oil prices remain a key sensitivity to the outlook for LNG export earnings. If the JCC oil price forecast was reduced by US\$5 a barrel, projected LNG export earnings would be \$2.7 billion lower in 2018–19 at \$34.3 billion.

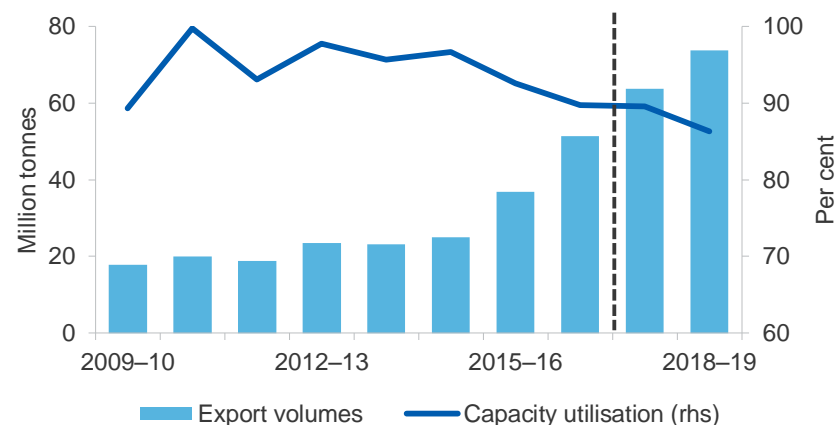
Some uncertainty also surrounds the outlook for export volumes. Competition in global LNG markets is set to intensify over the next few years, and the average capacity utilisation of Australian LNG plants is expected to edge down.

The extent of the decline will depend on the cost competitiveness of Australian LNG projects and the amount of flexibility in Australian LNG contracts. LNG contracts often include clauses which allow buyers to reduce purchases to minimum ‘take-or-pay’ levels. It is possible buyers may utilise these provisions if oil-linked contract prices remain higher than spot prices, or if they become over-contracted for LNG.

The Australian Domestic Gas Security Mechanism (ADGSM) has the potential to affect future LNG exports. The ADGSM will allow the Australian Government to restrict LNG exports if a gas supply shortfall is projected in the domestic market. LNG exporters that are net contributors to the domestic market will not be affected, but those that are not net contributions may have their exports capped.

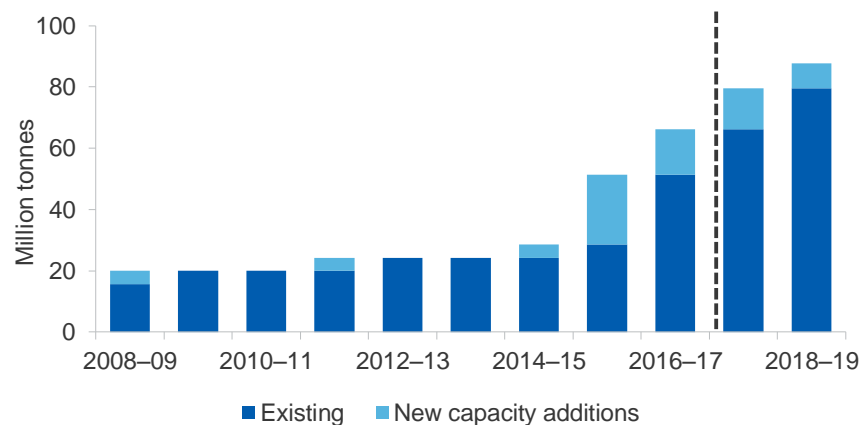
On current projections, Australia will overtake Qatar as the world’s largest LNG exporter in 2019, when Australian LNG exports reach 76 million tonnes. However, this is not a certainty: the difference between the projected exports of the two countries is narrow, and downside risks to the outlook for the Australian LNG exports remain.

Figure 7.11: Australia’s LNG exports and capacity utilisation



Notes: Utilisation shown as a share of nameplate capacity. Office of the Chief Economist estimates are used when LNG trains are ramping up to full capacity.
Source: ABS (2017); Department of Industry, Innovation and Science (2017)

Figure 7.12: Australian LNG export capacity



Note: nameplate capacity.
Source: Department of Industry, Innovation and Science (2017)

Table 7.1 Gas outlook

						Annual percentage change		
World	Unit	2016	2017 f	2018 f	2019 f	2017 f	2018 f	2019 f
JCC oil price a								
– nominal	US\$/bbl	41.9	53.7	57.6	61.1	28.3	7.3	6.0
– real h	US\$/bbl	42.8	53.7	56.3	58.3	25.4	4.8	3.6
Gas production t	Bcm	3 608.9	3 650.0	3 737.3	3 780.6	1.1	2.4	1.2
Gas consumption t	Bcm	3 607.8	3 650.8	3 740.2	3 784.7	1.2	2.4	1.2
LNG trade d	Mt	258.0	278.8	297.9	319.9	8.0	6.9	7.4
						Annual percentage change		
Australia	Unit	2015–16	2016–17 s	2017–18 f	2018–19 f	2016–17 s	2017–18 f	2018–19 f
Production b	Bcm	88.2	104.6	126.0	139.5	18.7	20.4	10.7
– Eastern market	Bcm	43.4	54.2	57.1	55.1	24.9	5.3	-3.4
– Western market	Bcm	43.8	49.1	67.0	74.0	11.9	36.4	10.5
– Northern market c	Bcm	0.9	1.4	2.0	10.4	47.1	46.3	423.2
LNG export volume d	Mt	36.9	51.5	63.8	73.8	39.7	23.9	15.7
– nominal value	A\$m	16,576	22,693	32,017	38,675	36.9	41.1	20.8
– real value	A\$m	16,866	22,693	31,343	37,046	34.6	38.1	18.2
LNG export unit value g								
– nominal value	A\$/GJ	8.5	8.3	9.5	9.9	-2.0	13.9	4.4
– real value e	A\$/GJ	8.7	8.3	9.3	9.5	-3.7	11.5	2.2
– nominal value	US\$/MMBtu	6.6	6.6	7.4	7.9	0.8	12.5	5.8
– real value e	US\$/MMBtu	6.7	6.6	7.3	7.5	-1.0	10.2	3.5

Notes: **a** JCC stands for Japan Customs-cleared Crude **b** Production includes both sales gas and gas used in the production process (i.e. plant use) as well as ethane. Historical gas production data was revised in the June quarter 2017 to align with Australian Petroleum Statistics published by the Department of Environment and Energy. **c** Gas production from Bayu-Undan Joint Production Development Area is not included in Australian production. Browse basin production associated with the Ichthys project is classified as Northern market. **d** 1 million tonnes of LNG is equivalent to approximately 1.36 billion cubic metres of gas. **e** In 2016–17 Australian dollars. **f** forecast. **g** 1 MMBtu is equivalent to 1.055 GJ. **h** In 2017 US dollars. **s** estimate. **t** estimate for 2016.

Source: ABS (2017) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Department of Industry, Innovation and Science (2017); Company reports; Nexant World Gas Model (2017).