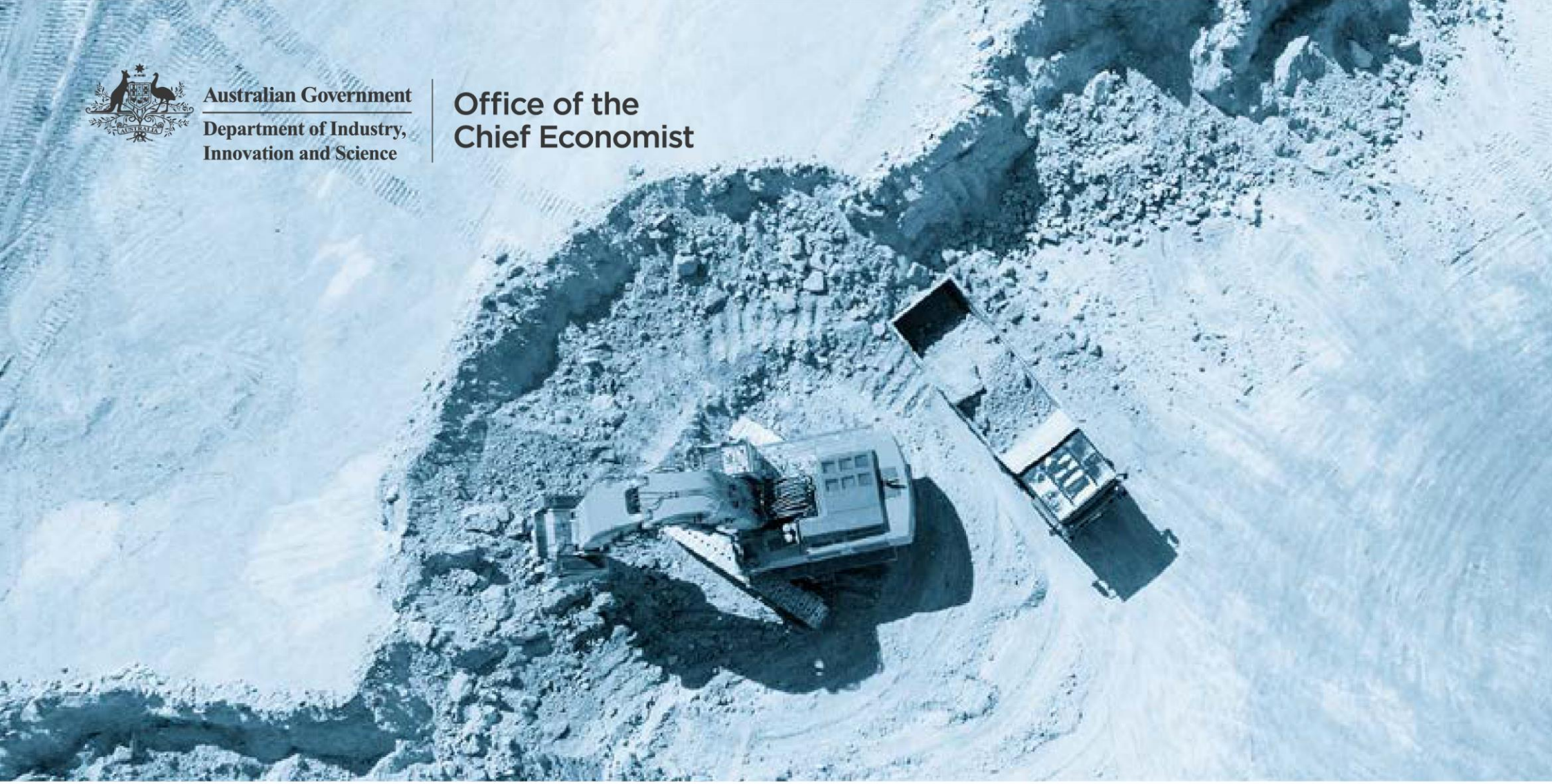

Australian Government
Department of Industry, Innovation and Science

Office of the Chief Economist

Resources and Energy Quarterly

December 2017

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Further information

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Note

Corrections were made to Chapter 15 (Major Projects) on 10 January 2018. As a result, some numbers reported in the text and tables have changed from the original report published on 8 January 2018.

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Contents

Foreword

Commodity prices resumed their decline in the December quarter 2017 — although their impact on export earnings was offset by a depreciation in the Australian dollar. Nonetheless, resources and energy export earnings are forecast to grow in 2017–18, to reach a (nominal) record of $214 billion, driven by growing LNG and iron ore export volumes. In 2018–19, prices are expected to weigh more heavily on export earnings, which are forecast to decline to $200 billion.

Between 2016–17 and 2018–19, LNG is expected to add $14 billion to Australia's export earnings, while coal and iron ore are forecast to subtract $11 billion and $10 billion, respectively.

Growing LNG export volumes, attributed to the completion of the three remaining LNG projects currently under construction — Wheatstone, Ichthys and Prelude — will underpin growth in LNG export earnings out to 2018–19, while declining iron ore and coal prices are expected to drive the forecast decline in overall resources and energy export earnings.

Steel production cuts in China have placed downward pressure on the price of Australia's biggest export — iron ore — in the December quarter. Continued moderation in Chinese steel production, coupled with increased supplies from both Australia and Brazil, are expected to weigh further on iron ore prices over the next two years. Coal prices — both thermal and metallurgical — are also forecast to weigh heavily on Australia's export earnings in the next two years, due to rising global supply and moderating demand.

The outlook for base metals prices are generally more optimistic than for iron ore and coal (although mixed across the individual commodities). Strong growth in global industrial production — particularly the manufacturing of stainless steel, vehicles and aluminium-based packaging — and infrastructure development, particularly in China, has boosted demand.

This edition of the *Resources and Energy Quarterly* contains a special chapter on *Resources and Energy Major Projects.* The chapter reveals that while mining investment activity is likely to continue to decline in the short-term, a slight uptick in projects that have been publicly announced or under feasibility, points to a bottoming in the investment cycle, beyond 2017–18. Recent increases in exploration activity also have the potential to translate to higher investment in the longer term.

Mark Cully

Chief Economist
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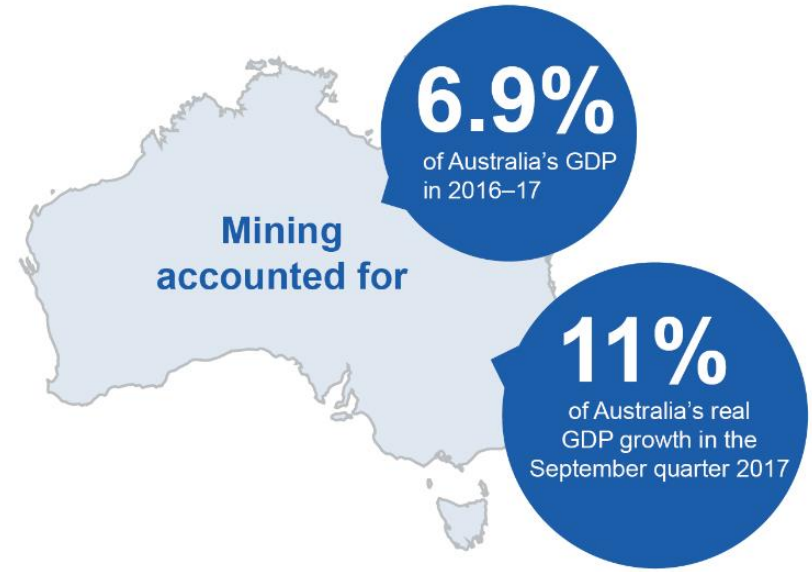
About this edition

The *Resources and Energy Quarterly* contains the Office of the Chief Economist's forecasts for the value, volume and price of Australia's major resources and energy commodity exports. Each March edition of *Resources and Energy Quarterly* features a 'medium term' (five year) outlook for Australia's major resource and energy commodity exports. The June, September and December quarter editions of *Resources and Energy Quarterly* contain a 'short term' (two year) outlook. This edition updates the Office of the Chief Economist's outlook out to 2018–19.

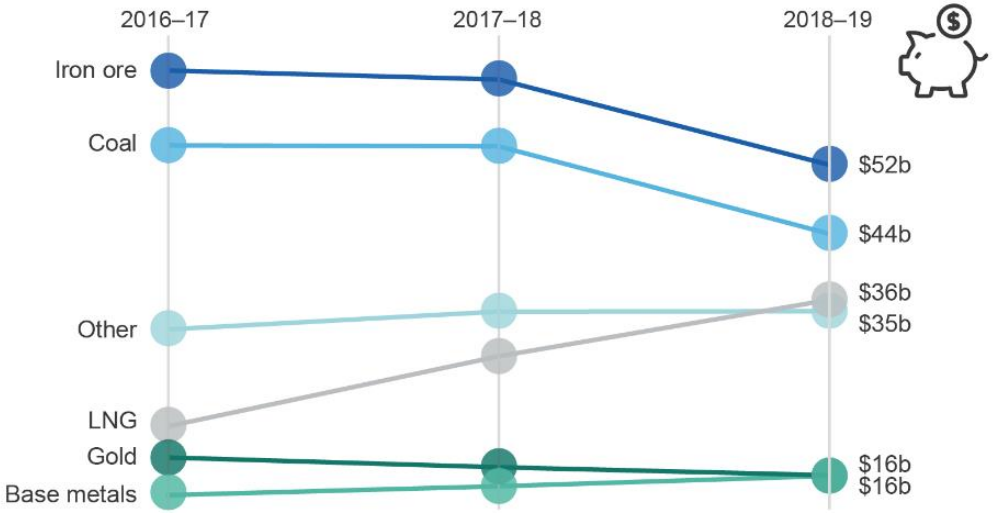
Underpinning the forecasts contained in the *Resources and Energy Quarterly* is the Office of the Chief Economist's outlook for global commodity prices, demand and supply. The forecasts for Australia's commodity exporters are reconciled with this global context. The global environment in which Australia's producers compete can change rapidly. Each edition of the *Resources and Energy Quarterly* factors in these changes, and makes appropriate alterations to the outlook, estimating the impact on Australian producers and the value of their exports.

Overview

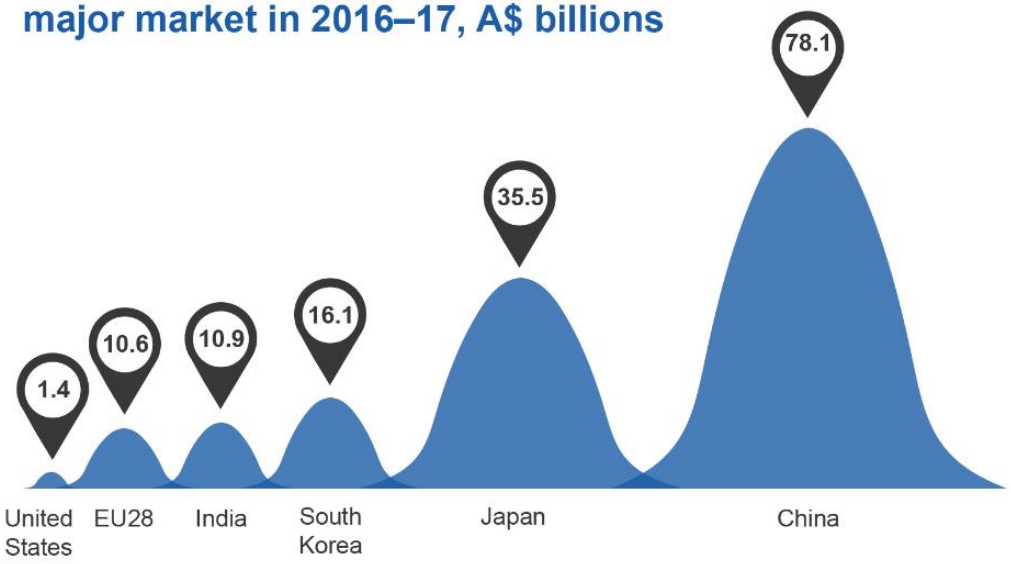
Resources and Energy Quarterly December 2017



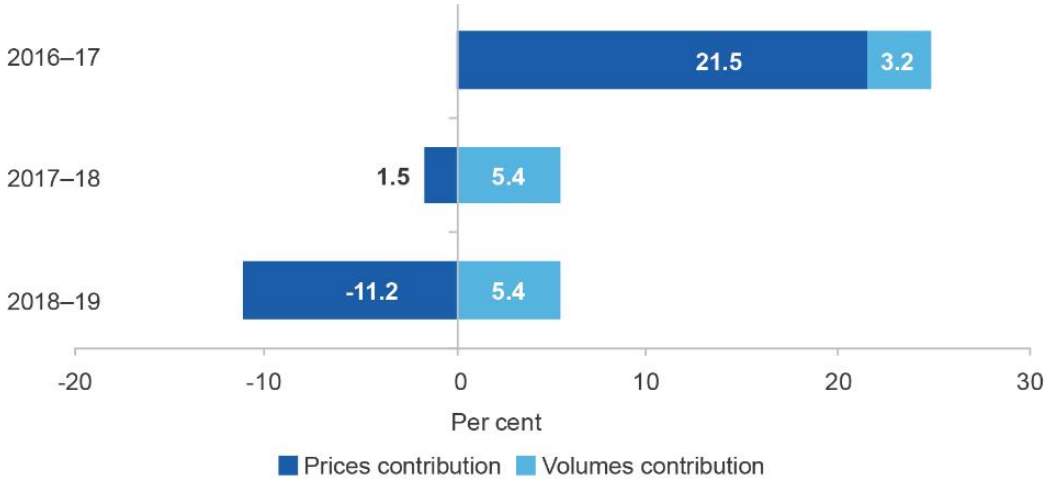
Australia's resources and energy commodity exports, A$ billions



Australia's resources and energy exports by major market in 2016–17, A$ billions



Australia's resources and energy exports growth, contributions from price and volumes



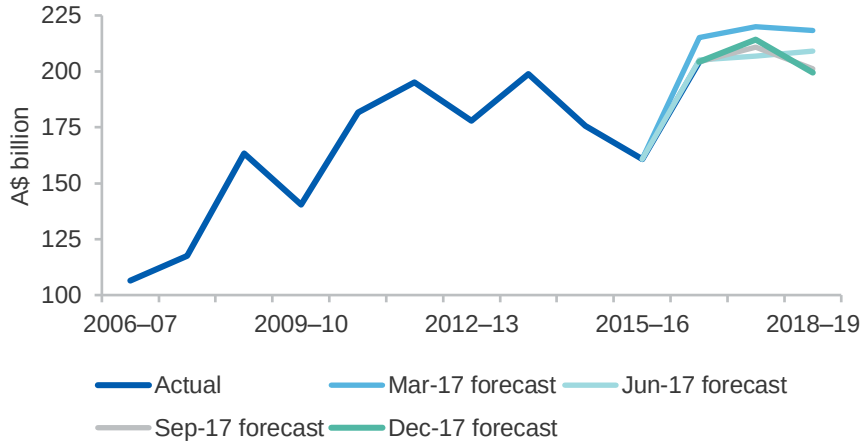
1.1 Revisions to the outlook

Since the September 2017 *Resources and Energy Quarterly*, the forecast value of Australia's resources and energy export earnings in 2017–18 has been revised up by $3.3 billion (1.6 per cent) to $214 billion. The outlook for 2018–19 has been revised down slightly, by $1.4 billion (0.7 per cent) to $200 billion.

The upward revision for 2017–18 primarily reflects higher than previously forecast iron ore, thermal coal and metallurgical coal prices. The iron ore price in particular has held up much more than previously anticipated. Nonetheless, the outlook still remains for declining iron ore prices into 2018–19. Partially offsetting these upward revisions were minor downward revisions to forecast export earnings for alumina, gold and LNG.

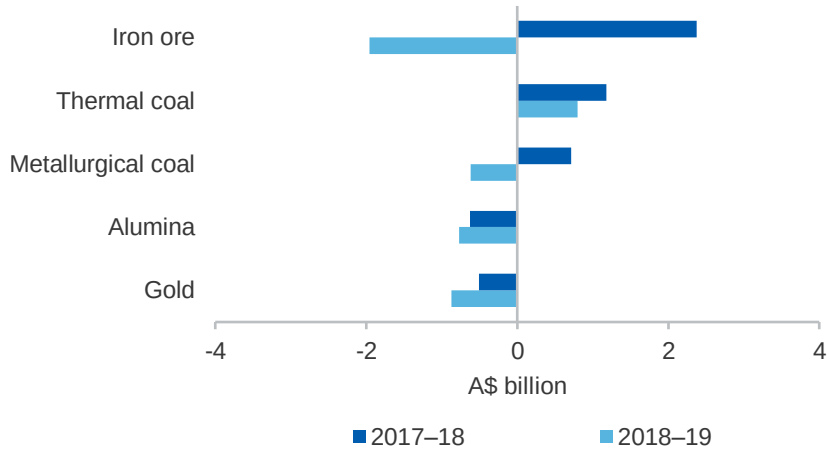
A downward revision to iron ore export volumes in 2018–19 is the primary driver for the downward revision to export earnings. The revision to export volumes reflects new production guidance from iron ore producers.

Figure 1.1: Revisions to export earnings



Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Figure 1.2: Largest revisions to export earnings, September 2017 to December 2017



Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

1.2 Summary

- Global economic growth, industrial production and manufacturing output gathered pace in 2017, indicative of a positive environment for commodity demand.
- Commodity prices, however, continued their downward trend in the December quarter 2017. Prices are forecast to decline by 2.0 per cent in 2017–18 and by a further 10 per cent in 2018–19, largely weighed down by the steel-making commodities iron ore and metallurgical coal. Demand for steel is expected to soften in China, the world's largest steel producing country.
- Australia's resources and energy export volumes are expected to continue to grow at a robust pace over the next two years, driven by LNG and, to a lesser extent, iron ore.

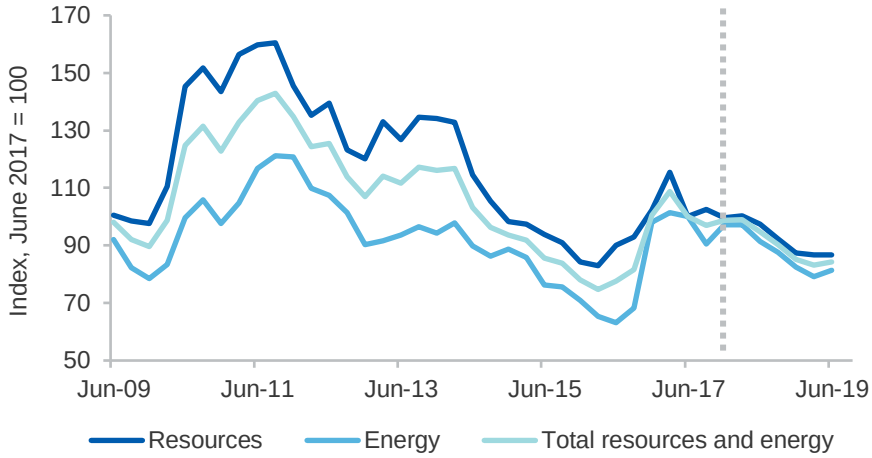
Commodity prices were lifted by a depreciation in the Australian dollar

In Australian dollar terms, the Office of the Chief Economist's (OCE) Resources and Energy Commodity Price Index grew by 1.8 per cent (preliminary estimate) in the December quarter 2017, to be 1.9 per cent lower than a year earlier. The rise in commodities prices in the December quarter was attributed to a depreciation in the Australian dollar — in US dollar terms commodity prices declined by 0.8 per cent.

Prices for energy commodities grew by 7.4 per cent while prices for resources commodities declined by 2.8 per cent, in Australian dollar terms.

A 9.3 per cent drop in the price that Australian iron ore exporters received drove the decline in resources prices, while increases in metallurgical coal, LNG and crude oil export prices boosted energy prices.

Figure 1.3: Resources and energy export prices



Notes: The export price index is based on Australian dollar export unit values (EUVs, export values divided by volumes); the export price index is a Fisher Price Index, which weights each commodity's EUV by its share of total export values

Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Winter steel production cuts in China have resulted in some ongoing volatility in the iron ore price in the December quarter. The iron ore price is forecast to gradually decline over the next two years, as Chinese steel production eases and Australian and Brazilian supplies continue to grow.

Metallurgical coal spot prices rose in the December quarter. Price strength derived from firm demand and concerns over supply, arising mainly from bottlenecks in the Australian export system. The winter curtailment of a significant amount of Chinese steel capacity is expected to take its toll on metallurgical coal prices in early 2018. Rising supply — due to the return of previously idled capacity and new project supply — is forecast to see prices ease over the course of 2018.

Thermal coal spot prices were steady. Prices are expected to ease through 2018 and early 2019, as supply rebounds from recent disruptions and demand moderates.

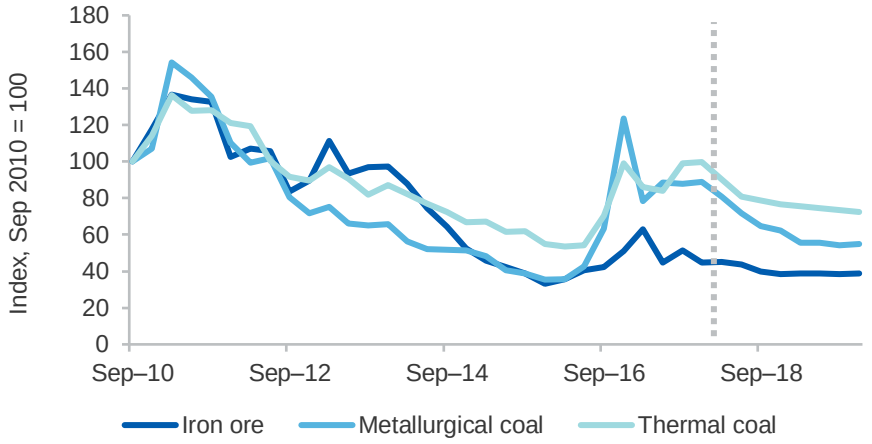
The price received by Australian LNG exporters (which is mostly on oil-linked contracts) has been broadly unchanged in recent months, reflecting relatively flat oil prices in mid-2017. However, LNG spot prices in Asia have risen sharply, driven by unplanned outages at a number of LNG facilities and strong pre-winter buying by key buyers in Asia (particularly China).

Gold prices were also relatively unchanged in the December quarter. A slight rise in the US dollar and real US Treasury bond yields was offset by the impact of persistent safe haven demand. Rising real US Treasury bond yields are expected to weigh on gold prices over the next two years, with investor caution over the outlook for the global economy boosting safe haven demand.

Base metal prices continued to increase in the December quarter and in some cases appear to be in a mini-boom. In particular, zinc prices are now the highest they have been since 2007, aluminium is the highest it has been since early 2012, copper is the highest since 2014 and nickel the highest since 2015. Strong growth in global industrial production — particularly the manufacturing of stainless steel, vehicles, aluminium-based packaging — and infrastructure development, particularly in China, has boosted demand for base metals.

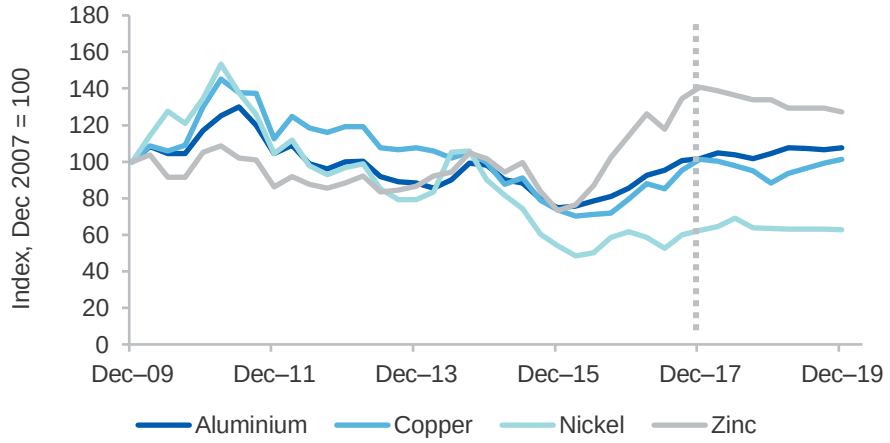
The two year outlook for base metals prices is mixed. Aluminium prices are forecast to increase as the Chinese authorities extend their air pollution controls, thus dampening output in the world's largest aluminium producer. Nickel is forecast to be relatively stable, while zinc and copper prices are forecast to decline slightly due to new supply coming online.

Figure 1.4: Bulk commodities spot prices



Notes: Prices are in US dollars, and are the international benchmark prices
Source: Bloomberg (2017)

Figure 1.5: Base metals spot prices



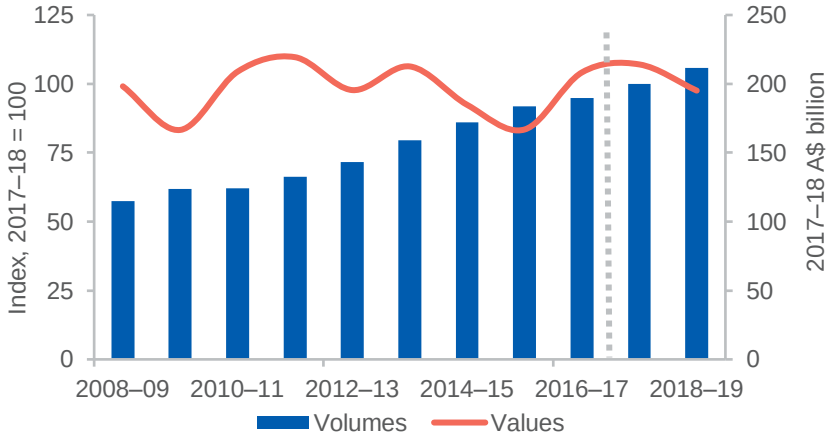
Notes: Prices are in US dollars, and are the international benchmark prices
Source: Bloomberg (2017) London Metals Exchange

Australia's export values to reach record high in 2017–18

The OCE's Resources and Energy Export Values Index (preliminary estimate) declined by 0.5 per cent year-on-year in the December quarter 2017. This was due to a 1.9 per cent drop in prices that more than offset a 1.2 per cent increase in volumes. Nonetheless, export values are forecast to grow by 4.9 per cent in 2017–18, to reach $214 billion. This would represent a record high, in nominal terms.

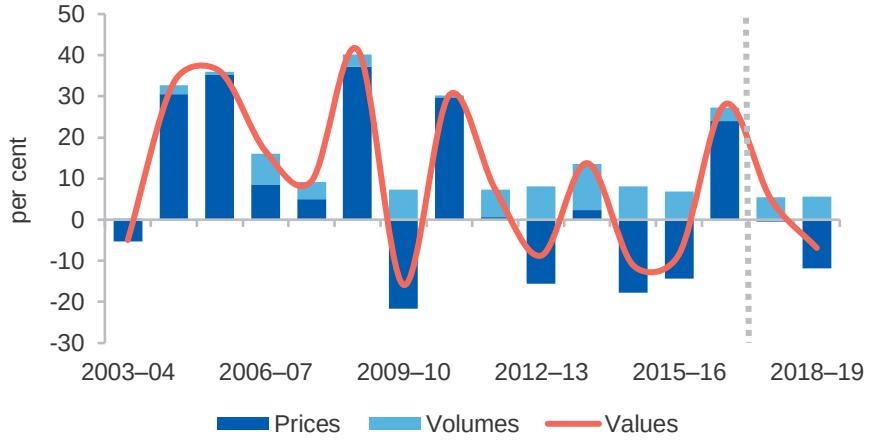
In 2018–19, an expected 12 per cent drop in prices is forecast to more than offset a solid 5.8 per cent increase in export volumes. As a result, export values are forecast to decline by 6.7 per cent.

Figure 1.6: Australia's resources and energy export values and volumes



Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Figure 1.7: Annual growth in Australia's resources and energy export values, contributions from prices and volumes



Source: ABS (2017) International Trade in Goods and Services, 5368.0

Export volumes to grow, driven by LNG and iron ore

The OCE's Resources and Energy Export Volumes Index (preliminary estimate) increased by 1.2 per cent year-on-year in the December quarter 2017, to reach a new record high. Export volumes are forecast to continue to grow over the outlook period, by 5.4 per cent in 2017–18 and by 5.8 per cent in 2018–19.

Export volumes in the December quarter were largely boosted by continued rapid growth in LNG exports, which increased by 21 per cent year-on-year. Increased production at Gorgon propelled LNG exports higher. Over the next two years, the completion of the three remaining LNG projects currently under construction — Wheatstone, Ichthys and Prelude — will also underpin resources and energy export volumes growth.

Iron ore also supported growth in overall resources and energy export volumes in the December quarter, rising by 4.2 per cent year-on-year. The pace of growth in iron ore exports volumes is forecast to be 6.2 per cent in 2017–18, before moderating to 1.6 per cent in 2018–19. Ongoing

productivity improvements and new additions to capacity will underpin the growth in iron ore exports volumes. This will be despite moderating steel production (and therefore iron ore demand) in Australia's largest export destination for iron ore — China. Australia's major iron ore suppliers are highly cost competitive and are expected to displace higher cost and lower quality Chinese mining operations.

Metallurgical coal export volumes may have grown to equal their highest level on record in the December quarter, and are forecast to remain steady in 2018–19. The potential for industrial action by miners at the Appin mine and rail workers in the Hunter Valley, as well as wet conditions in Queensland stemming from La Niña pose risks to the outlook for metallurgical coal.

Thermal coal export volumes are forecast to increase modestly in the next two years. Output is expected to be boosted by the ongoing expansions at Rolleston and at a significant number of mines in the NSW Hunter Valley region, including Ravensworth. Industrial action may also affect thermal coal production volumes.

Exports of gold and base metals, which have been declining in recent years, are forecast to return to growth. New productive capacity has been incentivised by a somewhat more supportive price environment in recent quarters. In particular, copper exports, which took a 12 per cent hit in 2016–17 are forecast to grow by 10 per cent in 2018–19, largely due to the expected completion of expansion works at BHP's Olympic Dam. Zinc exports dropped by a third in 2016–17 and are expected to grow by 18 per cent in 2018–19. The closure of MMG's Century mine in 2015 had a big impact on production volumes, but the recent surge in zinc prices has accelerated efforts to bring new capacity online.

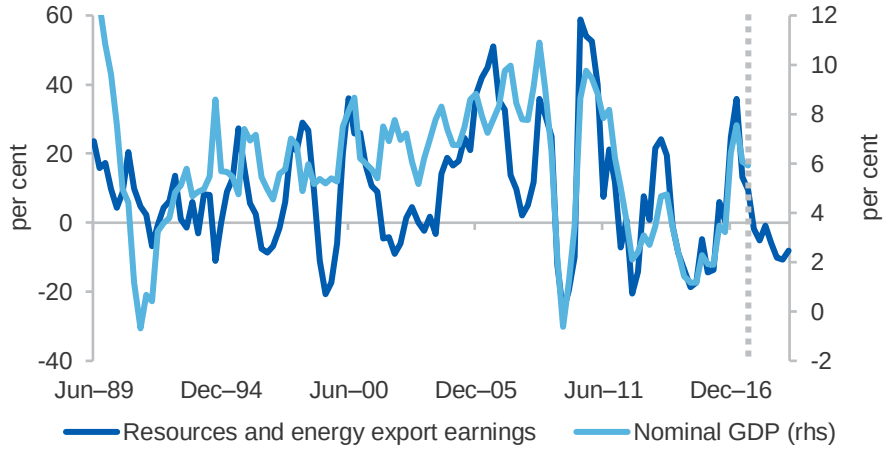
Mining industry continues to support overall economic growth

Australia's Gross Domestic Product (GDP) grew by 0.6 per cent in the September quarter 2017, with mining industry value-added growing by 1.1 per cent. The mining industry directly accounted for 11 per cent of the growth in Australia's GDP in the quarter.

Oil and gas extraction and iron ore mining have been the largest contributors to mining industry value-added growth in the last two years, propelled by growing export volumes. In the case of oil and gas extraction, the contribution of rapidly growing export volumes has been partially offset by declining investment (from a high base). In the coming few years, it is likely that slowing exports growth, coupled with continued investment declines, will see a declining contribution from the oil and gas sector to Australia's GDP growth. Nonetheless, the absolute value of oil and gas's contribution to Australia's economy will remain high for many years to come.

The contribution of mining services (particularly exploration services) to GDP is expected to grow in in the coming quarters, as a more supportive price environment (for gold and base metals) incentivises exploration activity.

Figure 1.8: Australia's nominal GDP vs resources and energy export earnings, year-on-year change



Source: ABS (2017) National Accounts, 5206.0; International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Mining industry investment expected to continue to decline

Real investment in Australia's mining industry was steady in the September quarter 2017, following twelve quarters of consecutive declines. Nonetheless, mining companies are expecting declines in nominal investment in the remainder of 2017–18. Mining investment is expected to decline by 31 per cent in 2017–18, to reach its lowest level in ten years.

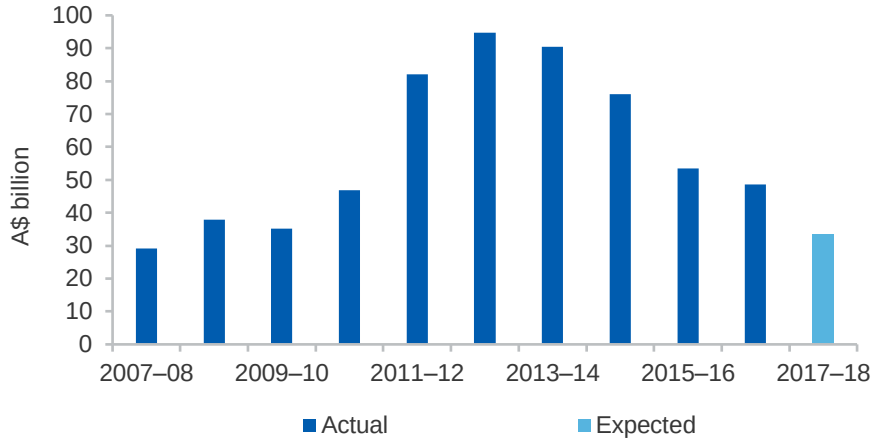
The decline in mining industry investment is consistent with the findings in the special chapter of this report, which provides an overview of the *Resources and Energy Major Projects*. Although timing can differ between the ABS and OCE surveys on mining industry investment — depending on when investment actually occurs versus when it is announced — both point to continued declines in mining investment activity in the short term. However, with the slight uptick in projects that have been publicly announced or under feasibility, as well as increased exploration activity, it is likely that mining investment is close to bottoming out beyond 2017–18.

Oil and gas investment remained the driver of declining mining investment in the September quarter, falling by 17 per cent year-on-year. This was partially offset by a 23 per cent increase in coal mining investment, while metal ore mining investment was relatively steady. Coal mining investment has now grown (year-on-year) for two consecutive quarters, following declines in every preceding quarter since March 2013.

The rapid decline in oil and gas investment in recent years reflects completion of some huge projects. In particular, the US$54 billion Gorgon LNG project was completed recently. With the completion of the three remaining LNG projects — Wheatstone, Ichthys, and Prelude — in 2018, oil and gas investment in Australia is expected to continue to decline in the short term, and weigh on overall mining investment.

For a more detailed discussion on mining projects and exploration activity, refer to the chapter on Resources and Energy Major Projects (*Chapter 15*).

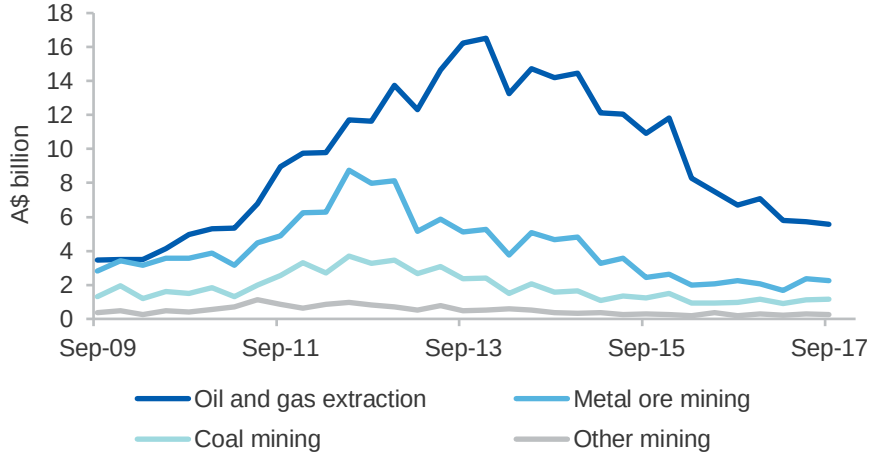
Figure 1.9: Mining industry capital expenditure, fiscal year



Notes: Chart data is in nominal terms

Source: ABS (2017) Private New Capital Expenditure and Expected Expenditure, 5625.0

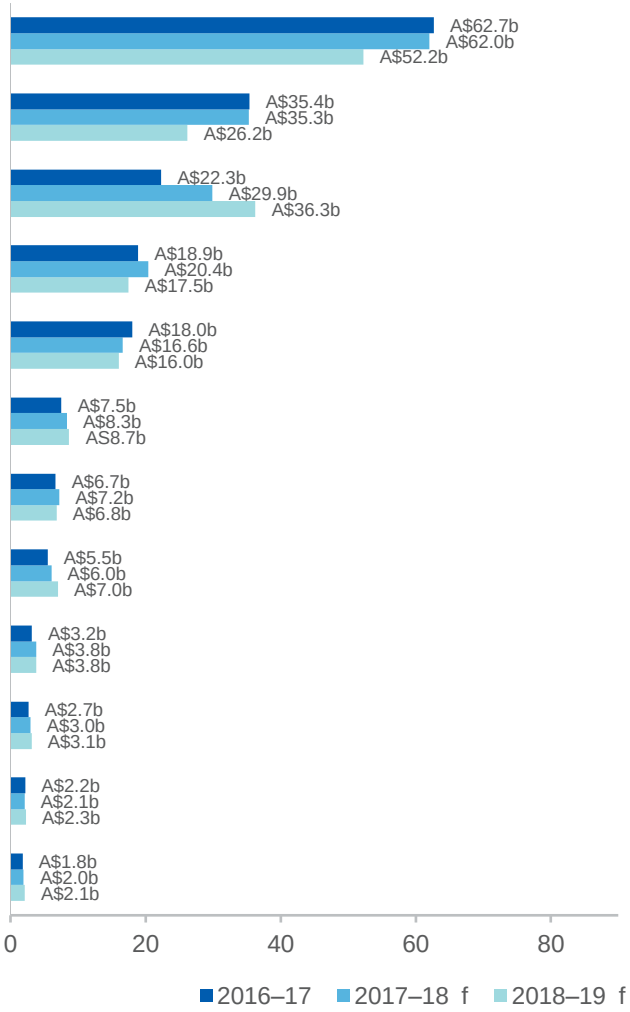
Figure 1.10: Mining industry capital expenditure by commodity, quarterly



Notes: Other mining includes non-metallic mineral mining and quarrying and exploration and other mining support services; chart data is in nominal terms

Source: ABS (2017) Private New Capital Expenditure and Expected Expenditure, 5625.0

Figure 1.11: Australia's major resources and energy commodity exports



Per cent change

	2017–18 f			2018–19 f		
	volume	EUV	value	volume	EUV	value
Iron ore	6	-7	-1	2	-17	-16
Metallurgical coal	8	-8	0	0	-26	-26
LNG	21	11	34	21	0	21
Thermal coal	1	6	8	-1	-14	-14
Gold	-5	-3	-8	3	-6	-4
Copper	-2	12	11	6	-2	4
Alumina	-1	9	8	-2	-3	-5
Crude oil	4	6	10	17	-1	16
Aluminium	7	12	20	-1	2	0
Zinc	2	9	11	18	-12	4
Nickel	-6	0	-5	8	1	9
Lead	9	0	10	13	-4	9

Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Table 1.1: Outlook for Australia's resources and energy exports

						Annual percentage change		
	Unit	2015–16	2016–17	2017–18 f	2018–19 f	2016–17	2017–18 f	2018–19 f
Resources and energy	A$m	160,767	204,117	214,112	199,768	27.0	4.9	-6.7
– real b	A$m	166,878	208,318	214,112	195,110	24.8	2.8	-8.9
Energy	A$m	59,791	85,349	95,218	90,890	42.7	11.6	-4.5
– real b	A$m	62,063	87,106	95,218	88,770	40.3	9.3	-6.8

Notes: **b** In 2017–18 Australian dollars; **f** forecast.
Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

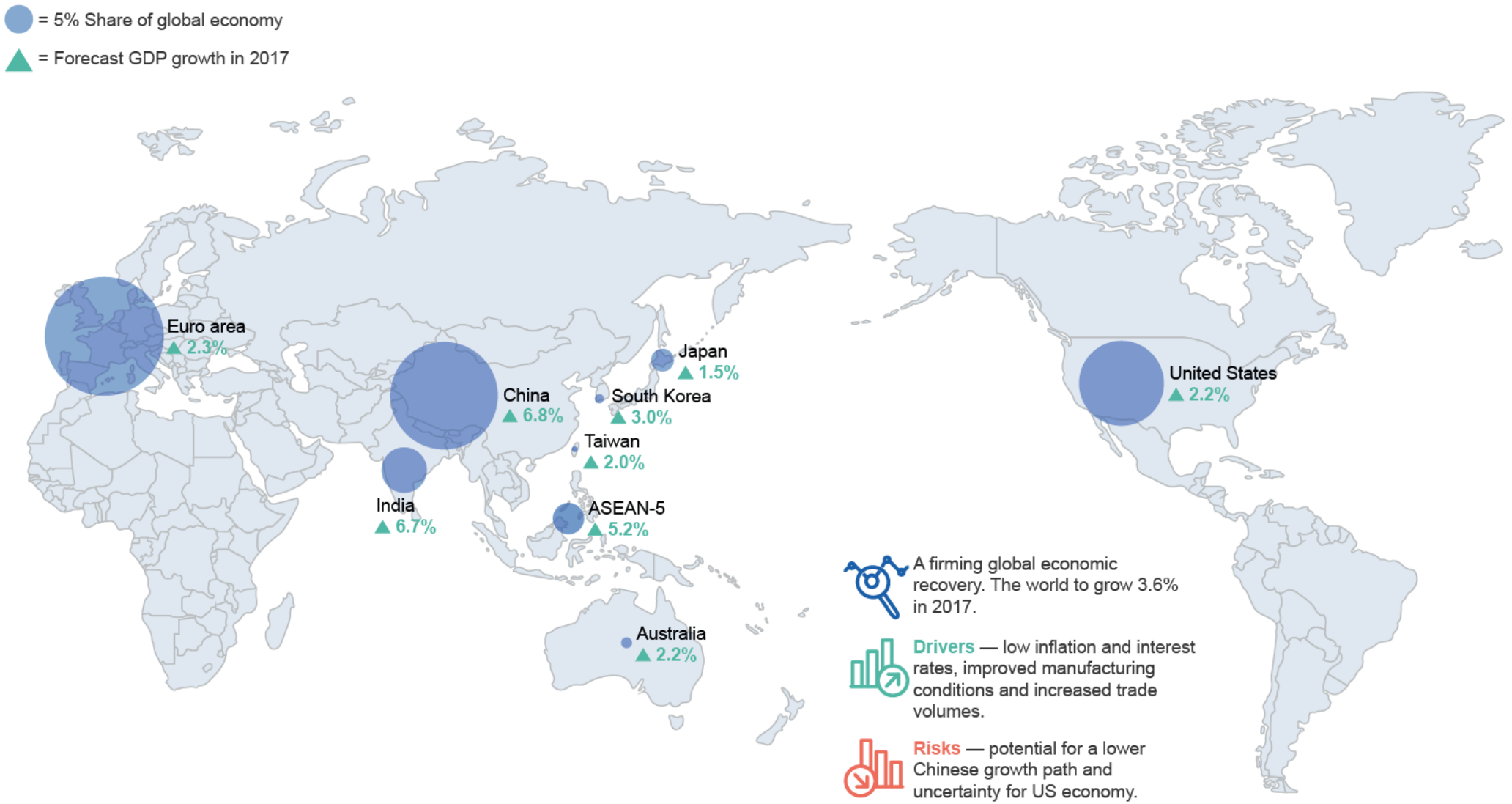
Table 1.2: Australia's resources and energy commodity exports, selected commodities

	Volume				Value (2017–18 A$)			
	unit	2016–17	2018–19 f	CAGR	unit	2016–17	2018–19 f	CAGR
Alumina	kt	18,230	17,717	–1.4	A$m	6,655	6,825	1.3
Aluminium	kt	1,329	1,400	2.6	A$m	3,165	3,806	9.7
Copper	kt	921	994	3.9	A$m	7,540	8,680	7.3
Gold	t	334	325	–1.3	A$m	18,013	16,010	–5.7
Iron ore	Mt	818	883	3.9	A$m	62,689	52,231	–8.7
Nickel	kt	175	178	0.7	A$m	2,199	2,270	1.6
Zinc	kt	1,008	1,212	9.7	A$m	2,688	3,118	7.7
LNG	Mt	52	77	21.2	A$m	22,299	36,392	27.7
Metallurgical coal	Mt	177	193	4.2	A$m	35,363	26,213	–13.9
Thermal coal	Mt	202	203	0.4	A$m	18,903	17,492	–3.8
Oil	kbd	221	269	10.5	A$m	5,476	7,008	13.1
Uranium	t	7,081	7,100	0.1	A$m	596	635	3.2

Notes: **f** forecast; CAGR is compound annual growth rate in percentage terms from 2016–17 to 2017–18
Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Macroeconomic outlook

Resources and Energy Quarterly December 2017



2.1 Summary

- The global upswing in economic activity is strengthening, with global growth forecast to rise to 3.6 per cent in 2017 and 3.7 per cent in 2018 and 2019.
- The potential for a lower Chinese growth path and uncertainty around the US economy represent risks to the outlook.

2.2 Global economic outlook

World industrial production — an important indicator of resource and energy commodity demand — continued to grow at a robust pace in the September quarter. Industrial production grew by 3.5 per cent — the fastest rate of growth since 2011.

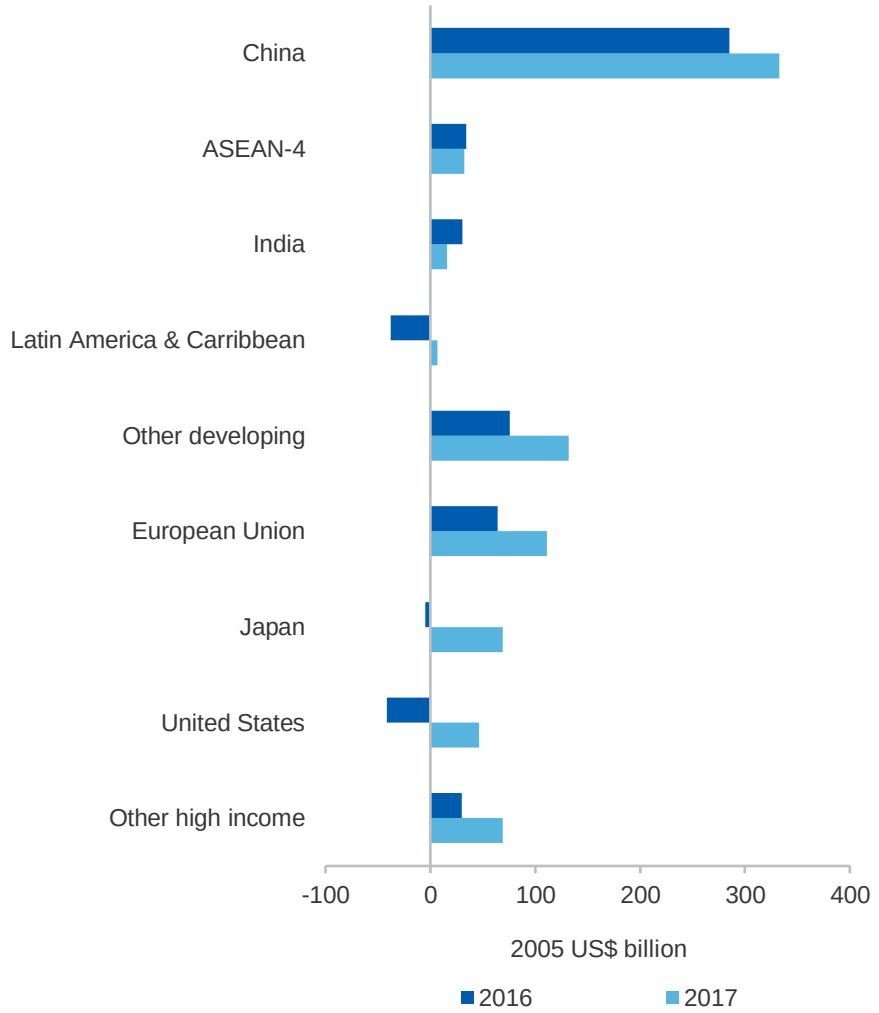
As demonstrated in Figure 2.1, China remains the key driver of world industrial production, accounting for around 40 per cent of growth in the year to September 2017. Growth in industrial production has also picked up markedly in high income countries, particularly Japan and the United States (which both fell in 2016), as well as the European Union.

However, growth in global automobile sales appear to have slowed so far in 2017, growing by only 2.9 per cent in the calendar year to September, compared with the 6.9 per cent growth recorded in 2016. In particular, vehicle sales have declined in the United States (down 1.8 per cent) and South Korea (down 0.7 per cent). Vehicle sales in China — the world's largest consumer of vehicles — grew by 4.8 per cent. Automobile manufacturing is an important source of demand for steel and aluminium.

More broadly, the global economic upswing appears to be strengthening, with global GDP growth forecast to gather speed in the next two years. The pickup in global growth is expected to be broadly based, accelerating in advanced and emerging market economies.

Following a slowdown in 2016, world merchandise trade in 2017 is estimated to have grown at the fastest rate in six years, mostly thanks to Europe's recovery. However, the potential for protectionist policies pose a risk to the medium term outlook for trade.

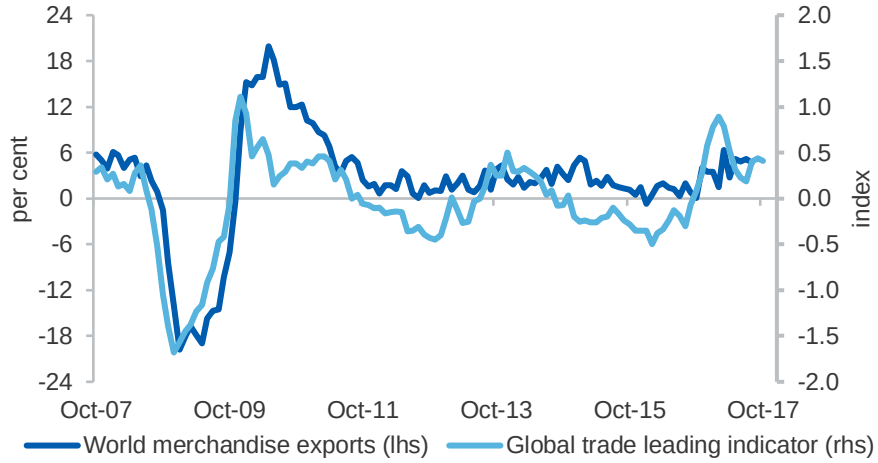
Figure 2.1: Annual growth in world industrial production



Notes: European Union excludes Greece and Malta, for which recent data was not available; ASEAN-4 includes Indonesia, Thailand, Malaysia and the Philippines

Source: World Bank Global Economic Monitor (2017)

Figure 2.2: World merchandise trade growth (year-on-year) and global trade leading indicator



Notes: The global trade leading indicator is a diffusion index: positive readings indicate expanding global trade, while a negative reading indicates contracting global trade.

Source: CPB Netherlands Bureau for Economic Policy Analysis; Morgan Stanley

2.3 China

Economic growth in China in 2017 was surprisingly robust — GDP growth is estimated to have accelerated from 6.7 per cent in 2016 to 6.8 per cent in 2017. This reflects economic stimulus, strengthening external demand and a payoff from domestic reforms. China's trade with the rest of the world is picking up, with recent growth at rates not seen since 2011. Exports in the year to October were up 7.5 per cent while imports rose by 17 per cent over the same period.

Between 2014 and 2016, the Chinese authorities reduced lending rates, eased real-estate macro-prudential policies and increased general government net borrowing. These policies contributed to a boom in construction and supported the demand for construction raw materials, many of which originate in Australia. However, since late 2016 the authorities have been gradually tightening financial conditions. As a result, construction investment is now declining and construction activity is beginning to slow.

At the 2017 Communist Party Congress, President Xi Jinping appeared to signal less focus on the pace of the expansion, and higher attention to tasks such as curbing pollution, taming financial risks and closing the income gap. A lower Chinese growth path would have a major impact on global commodity demand.

Figure 2.3: Indicators of Chinese construction activity, year-on-year change

Notes: Construction fixed asset investment is cumulative calendar year to date.

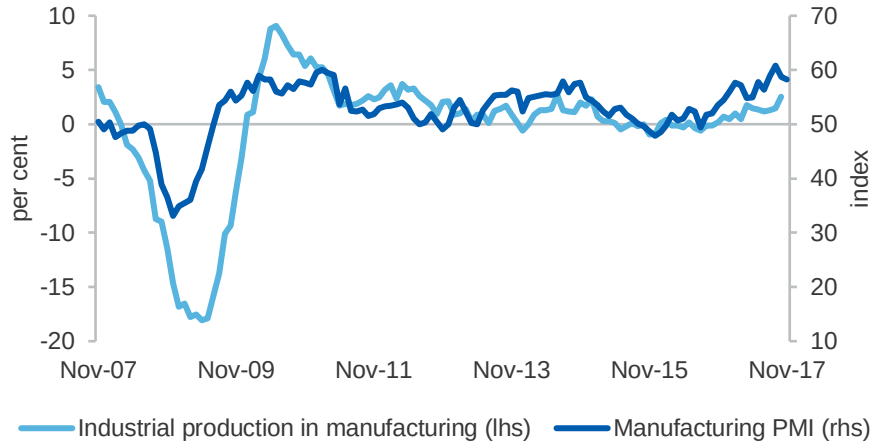
Source: National Bureau of Statistics China

2.4 United States

The US manufacturing industry continued to expand in November — with the manufacturing PMI dipping slightly further from a thirteen-year high reached in September. The dip in the index — through to levels which still point to an expansion in manufacturing activity — was attributed to post-hurricane supply-chain difficulties, and is expected to impact activity for the next three months. The US manufacturing PMI — which tends to lead industrial production in manufacturing — points to a pickup in economic activity in the manufacturing sector in the coming months.

Activity in the US construction sector also appears to be improving. Construction starts — according to the Dodge Construction Index — have grown by 10 per cent in the calendar year to October 2017. This is well above the 2.8 per cent growth recorded in 2016.

Figure 2.4: Indicators of activity in the US manufacturing sector



Notes: The manufacturing PMI is a diffusion index, where a reading above 50 indicates expansion in the industry, and a reading below 50 indicates contraction

Source: US Federal Reserve; Institute for Supply Management

There appears to be a lot of optimism around the US economy at present, with economic activity expected to pick up in the short term. US GDP growth is forecast to increase from 1.5 per cent in 2016 to 2.2 per cent in 2017 and 2.3 per cent in 2018. This optimism is also reflected in financial markets' expectations for company profits, with the US S&P 500 hitting a new record high in November.

However, US economic growth may decelerate beyond 2018. The spread between two year and ten year Treasury bond yields is the lowest it has been since the global financial crisis. This narrowing of the spread suggests that bond markets are pricing in a period of very low inflation and low economic growth.

The US Federal Reserve is continuing to gradually wind down the measures taken to mitigate the effects of the financial crisis. Should this occur more rapidly than anticipated, higher US interest rates may lead to a sizable tightening of global financial conditions. Countries with external imbalances or which are heavily reliant on external funding, particularly those in emerging Asia, may be vulnerable to higher US interest rates. Higher US interest rates may force these countries to increase their own domestic interest rates to avoid capital outflows. Higher interest rates would also dampen domestic investment and consumer demand, while raising public sector borrowing costs.

The US Government has just passed a tax reform bill, which went into effect on 1 January 2018. The full implications for economic growth and government debt are still unclear.

2.5 Other major markets

Industrial activity has also gathered pace in the major markets of the European Union, Japan and South Korea.

Japan's industrial production grew by 4.8 per cent in the calendar year to September 2017 — the fastest expansion since 2010. Favourable business conditions in Japan have been supported by ongoing easy monetary policy and a $US45 billion fiscal stimulus program which was launched in the second half of 2016. However, beyond 2017, economic and industrial production growth is forecast to slow significantly, as the fiscal support of recent years fades.

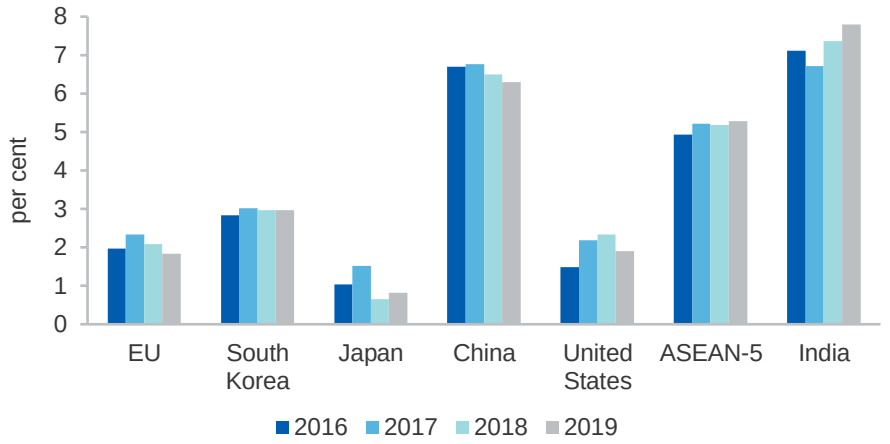
Economic activity in the Euro area in 2017 was supported by easy monetary conditions and an acceleration in exports amid a broader pickup in global trade. The Euro area's Composite PMI currently points to firm GDP growth over the coming few months. The Euro area's GDP growth is expected to moderate slightly in the next two years, held back by weak productivity and an aging population. Monetary policy is not expected to lend as much support as in the past few years.

Economic growth in the ASEAN-5 economies is also likely to have picked up in 2017, supported by improved external demand from China and Europe. Resilient domestic demand and a healthy global backdrop are expected to support solid (over 5 per cent) economic growth in the ASEAN region over the next two years. However, upcoming elections in Malaysia, Thailand and Indonesia could present short term hurdles.

Similarly, South Korea's economic growth likely picked up in 2017, supported by the recovery in global trade. The pick-up in exports and rising business and consumer confidence should continue to support economic growth in South Korea in the short term, with growth likely to be 3 per cent in 2018 and 2019.

India's economic growth is estimated to have slowed to 6.7 per cent in 2017 — reflecting disruptions associated with the currency exchange initiative (introduced in November 2016) as well as transition costs associated with the launch of the national Goods and Services Tax in July 2017. India's economic growth is expected to pick up in the next two years, but will likely depend on the impact of fiscal consolidation, removal of infrastructure bottlenecks, and the pace of revival of private investment and the banking sector.

Figure 2.5: Outlook for Gross Domestic Product by key markets



Source: IMF World Economic Outlook October 2017

Table 2.3: Key world macroeconomic assumptions

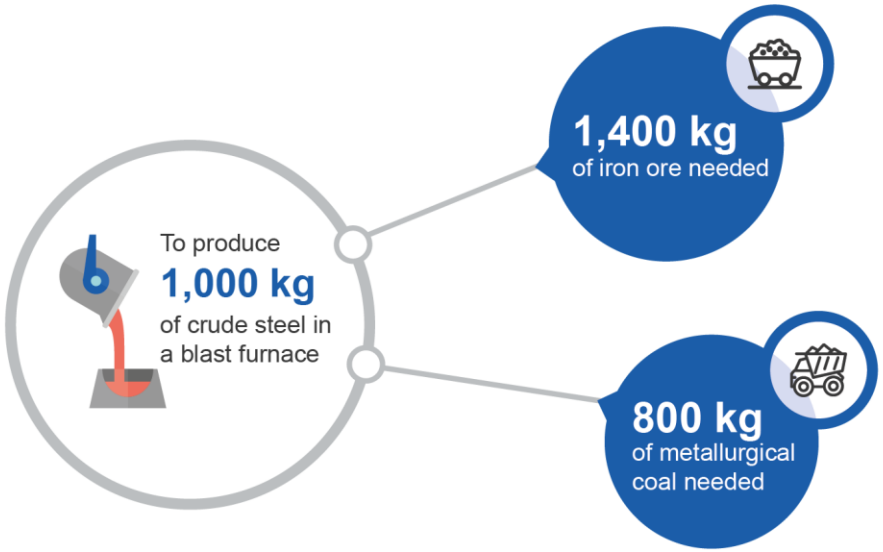
Per cent	2016	2017 a	2018 a	2019 a
Economic growth b				
Advanced economies	1.7	2.2	2.0	1.8
United States	1.5	2.2	2.3	1.9
Japan	1.0	1.5	0.7	0.8
European Union 28	2.0	2.3	2.1	1.8
Germany	1.9	2.1	1.8	1.5
France	1.2	1.6	1.8	1.9
United Kingdom	1.8	1.7	1.5	1.6
South Korea	2.8	3.0	3.0	3.0
New Zealand	3.6	3.5	3.0	2.5
Emerging economies	4.3	4.6	4.9	5.0
Emerging Asia	6.4	6.5	6.5	6.5
ASEAN-5 d	4.9	5.2	5.2	5.3
China e	6.7	6.8	6.5	6.3
Chinese Taipei	1.5	2.0	1.9	2.0
India	7.1	6.7	7.4	7.8
Latin America	-0.9	1.2	1.9	2.4
Middle East	5.1	2.2	3.2	3.2
World c	3.2	3.6	3.7	3.7
Inflation rate b				
United States	1.3	2.1	2.1	2.2

Notes: **a** Assumption; **b** Change from previous period; **c** Weighted using purchasing power parity (PPP) valuation of country gross domestic product by IMF; **d** Indonesia, Malaysia, the Philippines, Thailand and Vietnam; **e** Excludes Hong Kong

Source: IMF (2017) World Economic Outlook; Department of Industry, Innovation and Science

Steel

Resources and Energy Quarterly December 2017



Key producers, 2016

50% China

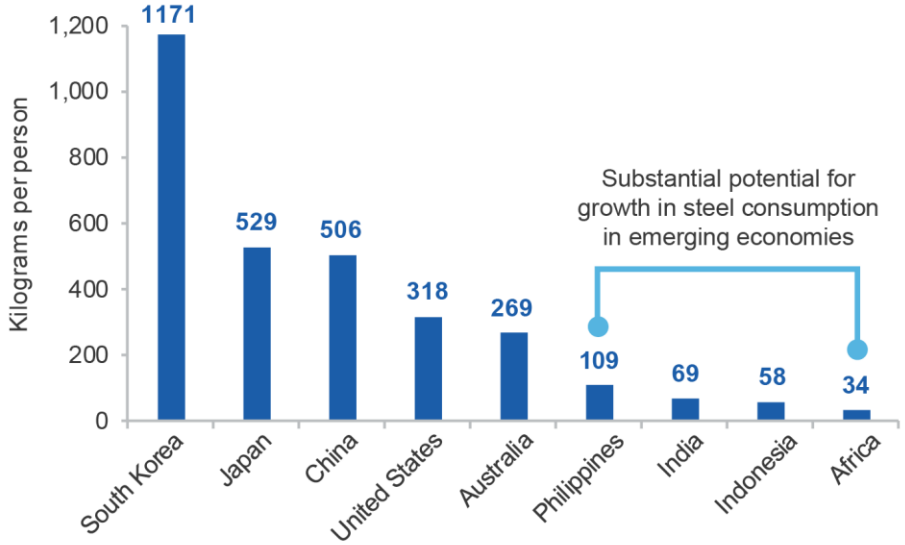
10% European Union

6.4% Japan

5.9% India

4.8% United States

Crude steel consumption per capita, 2016



Steel use by sector

50% Construction

16% Mechanical machinery

13% Automotive

5% Other transport

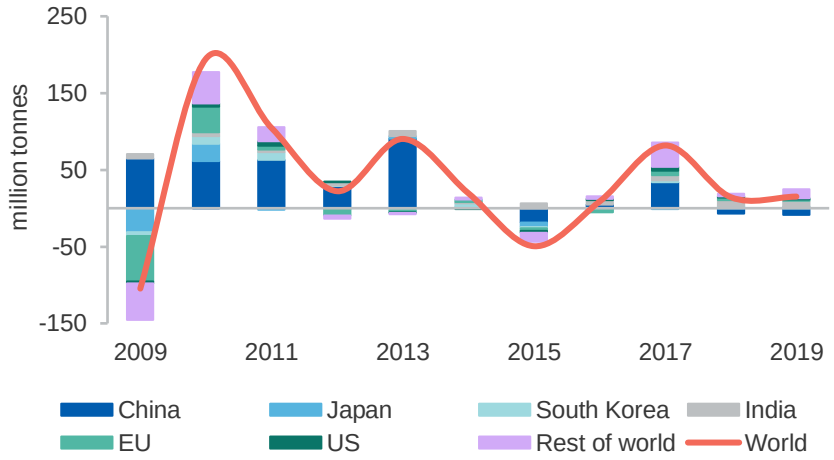
4% Electrical equipment

2% Domestic appliances

3.1 Summary

- Robust growth in world steel production and consumption in 2017 was supported by stimulatory policies in China (aimed at maintaining firm economic growth), and growing momentum in economic activity in the rest of the world.
- The pace of production and consumption growth is forecast to slow in 2018 and 2019, as the gradual effects of economic reforms and increasingly stringent environmental regulations in China outweigh an ongoing pick-up in growth elsewhere in the world.

Figure 3.1: Annual growth in world steel production



Source: Bloomberg (2017) World Steel Association; Department of Industry, Innovation and Science (2017)

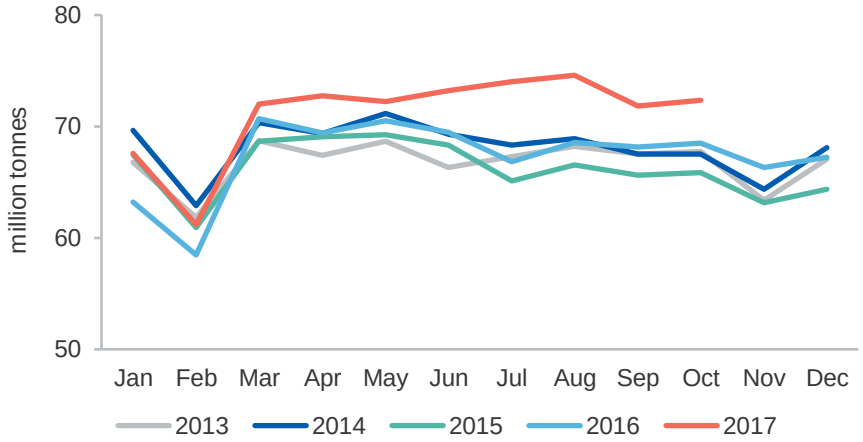
3.2 World production and consumption

China's steel production and consumption forecast to gradually ease following strong growth in 2017

China's steel sector was buoyed by strong margins and robust demand in 2017. The government-mandated closures of outdated capacity and illegal induction furnaces, and more recently, winter production restrictions, has tightened the domestic market and supported higher steel prices. Domestic steel consumption has been supported by government stimulus spending, infrastructure investment, and strong growth in the real estate and manufacturing sectors.

Capacity utilisation at the remaining mills has increased in response to higher prices and in anticipation of the winter production restrictions. While reported steel production growth has been strong — up 5.6 per cent in the year to October — this is also partly the result of the closure of induction furnaces. Production from closed illegal induction furnaces — an estimated 30 to 50 million tonnes of annual capacity — were not captured in official production statistics, and have since been at least partially replaced by increased production from reporting steel mills.

Figure 3.2: China's monthly steel production



Source: Bloomberg (2017) World Steel Association

China's steel production is expected to slow, as a result of restrictions imposed on northern steel mills from November to March to reduce air pollution. The loss in production in the north is expected to be partly offset by increased capacity utilisation in unaffected southern steel mills.

Steel production is expected to rebound after winter. Steel inventories going into winter are very low, which should provide some ongoing price support and incentivise output after the production restrictions are lifted. Beyond the first half of 2018, steel production is forecast to gradually ease. Steel production is expected to be weighed down by increasingly stringent environmental regulations and weaker demand, due to slowing fixed asset investment and a cooling property market.

Government policy will continue to drive the outlook for steel, with strong signals that environmental protection and economic reforms will be a key priority going forward. A renewed focus on a rebalancing of the sources of economic growth is expected to result in a shift away from (more steel-intensive) investment-led growth to (less steel-intensive) consumption-led growth. Ongoing urbanisation and opportunities stemming from the 'One Belt One Road' initiative is expected to continue to support steel demand, resulting in a gradual, rather than sharp, decline in steel demand.

India to become world's second largest steel producer in 2018

The ongoing expansion of India's steel capacity has driven strong output growth in 2017, up 5.8 per cent in the year to October. India's steel production is forecast to grow at an annual average rate of 6.6 per cent to reach 115 million tonnes in 2019, driven by new additions to capacity.

Most of the additional steel production is expected to be consumed domestically, underpinned by substantial government investment in infrastructure and urban development. India's steel consumption increased by 4.3 per cent in the six months to September. Steel demand is expected to improve as a result of economic reforms currently underway, and is forecast to accelerate over the next two years.

Improved economic conditions supporting the steel industry elsewhere

Japan's steel production has been broadly stable in 2017. Despite positive demand conditions from government stimulus and relatively strong economic growth, production was affected by scheduled maintenance and technical glitches at several mills throughout the year. Japan's steel production is forecast to increase over the next two years after these temporary halts to production. The outlook for Japan's steel demand remains positive, and is expected to be supported by growth in the automobile, construction and manufacturing sectors, in addition to increased demand from Olympics-related projects.

South Korea's steel output grew by 3.7 per cent in the year to October, with the sector benefiting from higher prices and exports. Steel output in South Korea is forecast to grow at an average of 1.8 per cent a year to reach 74 million tonnes in 2019. While demand is expected to be propelled by improvements in construction investment, government spending and private consumption, the nation's shipbuilding sector remains depressed.

Elsewhere in the world, steel production has increased, reflecting a steady improvement to global business confidence and industrial production indicators. Steel producers in developed countries, particularly in the US and EU, have also benefited from plunging steel exports from China, which has supported global steel prices. New additions to capacity have supported production growth in countries such as Iran and Vietnam.

In 2018 and 2019, the pace of global output growth is forecast to slow but remain relatively robust, supported by accelerating growth in developing economies and emerging markets and a further recovery in economic activity in the OECD.

Australia's steel production buoyed by strong demand

There has been increased optimism in Australia's steel industry. The sale of Arrium to the GFG Alliance has provided more certainty regarding the steelmaking operations, now trading as Liberty OneSteel. Australia's steel production is expected to be buoyed by strong domestic demand coming from the domestic construction sector, which has recently rebounded after several years of contraction.

Table 3.1: World steel consumption and production

	Million tonnes				Annual percentage change		
Crude steel consumption	**2016**	**2017 s**	**2018 f**	**2019 f**	**2017 f**	**2018 f**	**2019 f**
European Union 28	172	175	178	179	1.9	1.3	1.0
United States	103	104	107	107	1.6	2.7	-0.1
Brazil	20	21	24	26	5.9	10.6	8.5
Russia	42	42	42	41	-1.1	-0.9	-0.3
China	709	773	765	757	8.9	-1.0	-1.0
Japan	68	69	71	72	1.8	3.2	1.6
South Korea	59	59	58	58	-0.8	-1.0	-1.0
India	92	96	102	110	5.0	6.5	7.5
World steel consumption	1630	1710	1725	1738	4.9	0.9	0.8
Crude steel production							
European Union 28	162	168	172	173	3.7	2.0	0.8
United States	78	82	86	88	3.9	5.6	2.5
Brazil	31	34	36	38	8.5	6.0	4.9
Russia	71	73	73	72	3.0	-0.4	-0.2
China	808	842	835	826	4.2	-0.8	-1.1
Japan	105	105	107	108	-0.2	1.9	0.9
South Korea	69	71	72	74	3.7	1.7	1.9
India	96	101	108	115	5.8	6.6	6.6
World steel production	1,629	1,711	1,725	1,740	5.0	0.8	0.9

Notes: **s** Estimate; **f** Forecast

Source: World Steel Association (2017); Department of Industry, Innovation and Science (2017)

Iron Ore

Resources and Energy Quarterly December 2017

1st

Australia is the largest exporter of iron ore in the world

819 million tonnes exported in 2016–17

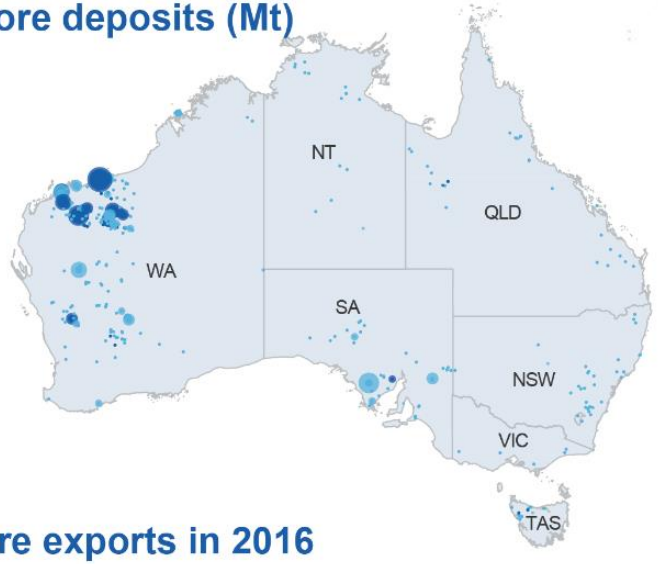
That's enough to build **9,700** Sydney Harbour bridges

$63 billion exported in 2016–17

28% of the world's iron ore reserves

Major Australian iron ore deposits (Mt)

- <229
- 230–813
- 814–1,777
- 1,778–3,042
- 3,043–5,446
- >5,447
- Deposit
- Operating mine



Global share of iron ore exports in 2016

53%	24%	4%	3%	3%	13%
Australia	Brazil	South Africa	Ukraine	Canada	Rest of the world

Australia's iron ore key export destinations, 2016–17

83%	8%	6%	2%	1%
China	Japan	South Korea	Taiwan	Rest of the world

Global share of iron ore imports in 2016

67%	10%	8%	5%	10%
China	European Union	Japan	South Korea	Rest of the world

4.1 Summary

- Australia's iron ore export earnings grew by 31 per cent to $63 billion in 2016–17, but are forecast to fall to $52 billion in 2018–19, as the impact of lower prices more than offsets growth in volumes.
- The iron ore price is forecast to decline to US$49 a tonne (FOB Australia) in 2019, due to growing low-cost supply from Australia and Brazil and moderating demand from China.
- The outlook for the iron ore price is sensitive to the pace and magnitude of the decline in China's steel production, which in turn, largely depends on government policy.

4.2 Prices

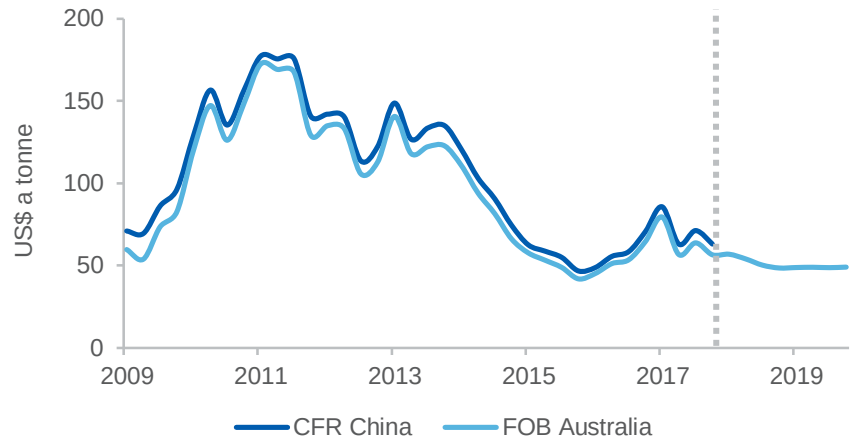
Iron ore price forecast to gradually decline following short-term support

The iron ore price is forecast to average US$53 a tonne (FOB Australia) in 2018, and decline to average US$49 a tonne in 2019. The iron ore price is expected to experience some ongoing volatility in early 2018, as the market responds to uncertainty regarding the impact of winter production restrictions on iron ore demand.

There are conflicting forces influencing the iron ore price. China's winter curtailment policy should result in a net loss of steel production, in turn, dampening iron ore import demand and placing downwards pressure on the iron ore price. However, the iron ore price has historically tracked China's steel prices quite closely, and the price is unlikely to experience substantial declines while steel prices and margins remain elevated.

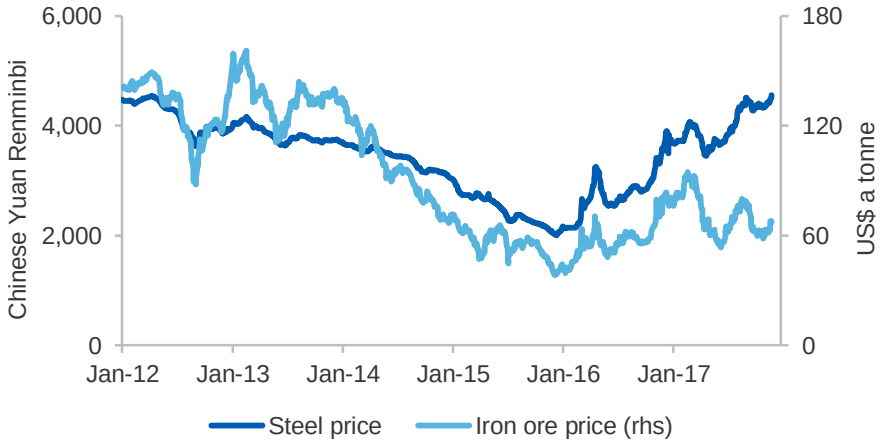
With steel prices and margins close to six-year highs and inventories at eight-year lows, it is likely that there will be robust growth in steel production and iron ore demand after the winter production restrictions are lifted. Demand for iron ore is also expected to be supported by a seasonal rebound in construction and manufacturing activity in China's spring months. The iron ore price has been revised up from the September 2017 *Resources and Energy Quarterly*, to average US$55 a tonne in the first half of 2018, reflecting short-term support from these drivers.

Figure 4.1: Iron ore price, FOB Australia and CFR China, quarterly



Source: Bloomberg (2017) Metal Bulletin; Department of Industry, Innovation and Science (2017)

Figure 4.2: Steel and iron ore prices, daily



Notes: Steel price is a composite index of prices in China. Iron ore price is for CFR China.

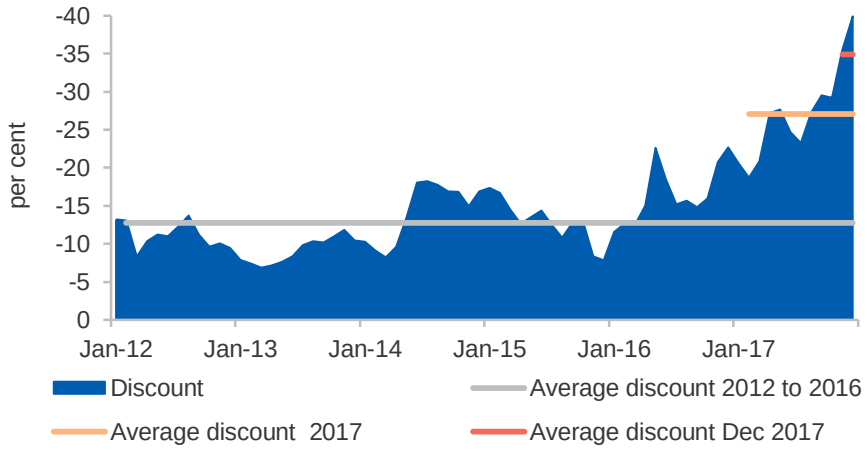
Source: Bloomberg (2017) Beijing Custeel E-Commerce Co.; Bloomberg (2017) Metal Bulletin

However, beyond the first half of 2018, the iron ore price is forecast to decline to US$49 a tonne, reflecting growing supply from low-cost producers in Australia and Brazil, and moderating demand from China as steel production eases. China's steel production is sensitive to a range of economic, monetary and environmental policies, and government policy remains the key uncertainty underpinning the outlook for the iron ore price.

Discount on lower grade ores likely to persist

An expected decline in steel prices over the next two years is likely to alleviate some of the downward pressure on lower grade ores, which experienced an average 35 per cent discount on the 62 per cent (premium grade) benchmark price in the December 2017 quarter. However, there are strong signals from the Chinese government that there will be an increasing emphasis on efficiency and addressing air quality concerns, supporting an ongoing preference for medium and high grade ores. As such, while the discount may narrow as steel prices decline, it is unlikely revert back to the historical average of 13 per cent.

Figure 4.3: Discount on 58 per cent fines



Notes: Discount is for 58 per cent relative to 62 per cent fines.
Source: Bloomberg (2017) Beijing Custeel E-Commerce Co.

4.3 World trade

China's iron ore imports forecast to be steady

China's iron ore imports increased by 5.7 per cent in the year to October, supported by robust steel production. China's demand for iron ore is forecast to gradually ease over the next two years, with opportunities from the 'One Belt One Road' initiative expected to partially offset the impact of slowing fixed asset investment and a cooling property market.

China's iron ore imports are forecast to remain largely steady, at around 1.05 billion tonnes to 2019, supported by a forecast decline in domestic iron ore output. China's iron ore is mostly low grade, making domestically-produced iron ore less competitive against imports, particularly as steel mills increasingly prefer higher quality iron ore. There are also government plans to cancel a third of iron ore mining licenses, predominantly from small, polluting mines, which should further weigh on domestic supply. However, China's iron ore operations tend to be highly responsive to prices, and there is potential for domestic iron ore production to decline slower than expected, which would result in lower import demand than currently forecast.

India's iron ore exports forecast to moderate

India's iron ore exports have surged in 2017, though from a low base. The rise was driven by more supportive government policies, including the easing of mining and export restrictions. India's iron ore exports are forecast to moderate over the next two years. India's rapidly growing steel industry is expected to consume more domestic iron ore, and exports will be weighed down by ongoing production and export restrictions and a 30 per cent tax on medium grade iron ore exports. The government reduced export taxes for low grade ores in 2016, however there has been a growing preference for medium and higher grade ore from steel mills in China. India's iron ore imports are forecast to remain low through to 2019, as domestic output largely satisfies local needs. The outlook for India's iron ore trade is sensitive to government policy, which has historically been more supportive of securing low cost inputs for the steel industry.

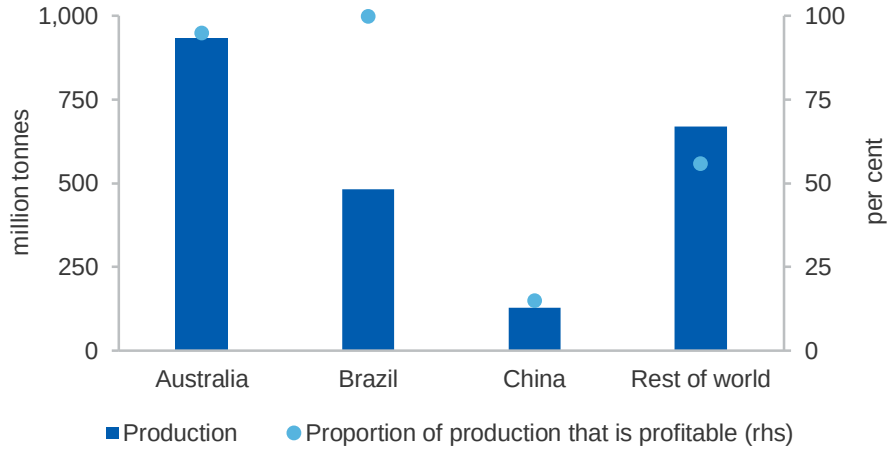
Iron ore exports from Brazil forecast to grow strongly

Strong growth in Brazil's iron ore exports will be driven by the ongoing ramp up of Vale's 90 million tonne S11D project. In its September quarterly report, Vale's production guidance of 360–380 million tonnes in 2017 was unchanged from the previous quarter, and a longer-term target of 400 million tonnes a year was reaffirmed. Anglo American Plc's Minas Rio expansion aims to increase annual output from 17 million tonnes to 26.5 million tonnes by 2019. However, ongoing delays in obtaining environmental permits puts the project at risk.

Seaborne trade to be dominated by Australia and Brazil

Rising iron ore prices in the last couple of years has resulted in increased iron ore production from smaller producers, however, this is likely to be temporary. Exports of medium grade ore from low-cost producers in Australia and Brazil are forecast to grow, placing downward pressure on the iron ore price and displacing higher cost and lower grade supply.

Figure 4.4: Iron ore production and profitability in 2019



Notes: Based on share of mines producing at a profit at a forecast US$49 a tonne.
Source: AME Group (2017); Department of Industry, Innovation and Science (2017)

The majority of Australia and Brazil's production is expected to remain profitable at the forecast price of US$49 a tonne in 2019. Both countries' share of global seaborne trade are forecast to increase, with Australia forecast to increase its market share from 53 per cent in 2016 to 54 per cent in 2019, and Brazil from 24 per cent in 2016 to 26 per cent in 2019.

4.4 Australia

Iron ore exploration expenditure stabilises

In the September 2017 quarter, iron ore exploration expenditure increased by 5.0 per cent year-on-year to $84 million. Australia's iron ore exploration expenditure totalled $291 million in 2016–17, stabilising after four consecutive years of large declines.

Australia's exports earnings continued to grow in the September quarter

In 2016–17, Australia's iron ore exports increased by 31 per cent to $63 billion in 2016–17, propelled by higher prices and, to a lesser extent, growth in export volumes. Export volumes rose by 4.1 per cent to 818 million tonnes, while production rose by 4.4 per cent to 872 million tonnes.

Australia's iron ore export earnings continued to grow in the September 2017 quarter, rising by 21 per cent year-on-year to $16 billion, while export volumes rose by 3.5 per cent to 212 million tonnes.

Production growth in the September 2017 quarter was supported by an increase in production at Rio Tinto's operations (due to productivity enhancement projects), at Roy Hill, which reached its nameplate capacity run rate of 55 million tonnes a year in September, and at Mount Gibson's Iron Hill project as it ramped up. However, there was lower production at BHP's operations, due to a fire at the Mt Whaleback screening plant in June 2017, and planned maintenance in the September quarter, which more than offset record production at Jimblebar.

Iron ore export earnings forecast to decrease but volumes forecast to rise

Australia's iron ore export earnings are forecast to decline over the next two years, by 1.0 per cent in 2017–18 to $62 billion, and by 16 per cent in 2018–19 to $52 billion. The decline in export earnings will be driven by the

forecast decline in the iron ore price. Export volumes are forecast to grow by 6.2 per cent in 2017–18 to 869 million tonnes, and by 1.6 per cent in 2018–19 to 883 million tonnes.

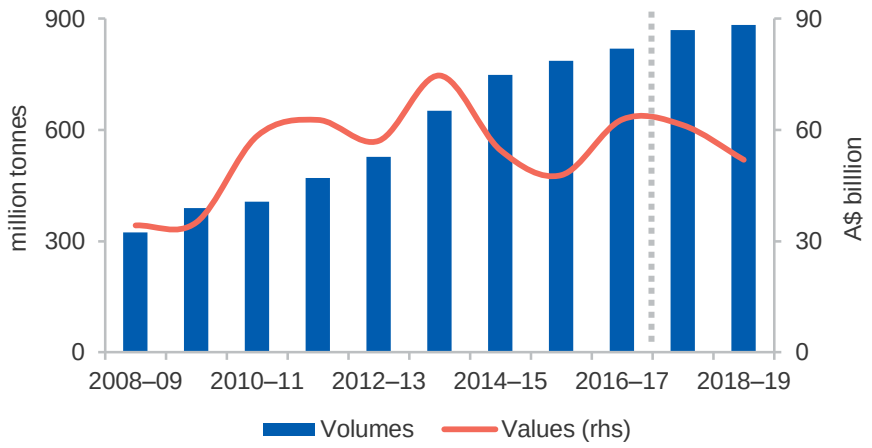
Growth in export volumes is expected to be supported by ongoing productivity improvements and new additions to capacity. The restart of Mount Gibson's Koolan Island project is on track to achieve first sales in early 2019. Rio Tinto's Silvergrass mine remains on target for completion, and will ramp up to full capacity in 2018. The automation of Rio Tinto's Pilbara train system remains on track for completion by the end of 2018, supporting further operational improvements. Rio Tinto announced production guidance of 330–340 million tonnes for 2018, and BHP expects production to be 275–280 million tonnes in 2017–18.

There are minor risks to the outlook for Australia's iron ore production. An estimated 95 per cent of Australia's iron ore production is expected to remain profitable at the forecast price of US$49 a tonne in 2019. However, margins will be tight at some operations with higher costs or lower grade ores, and some producers may be exposed to persistently low prices.

Revisions to forecast export values

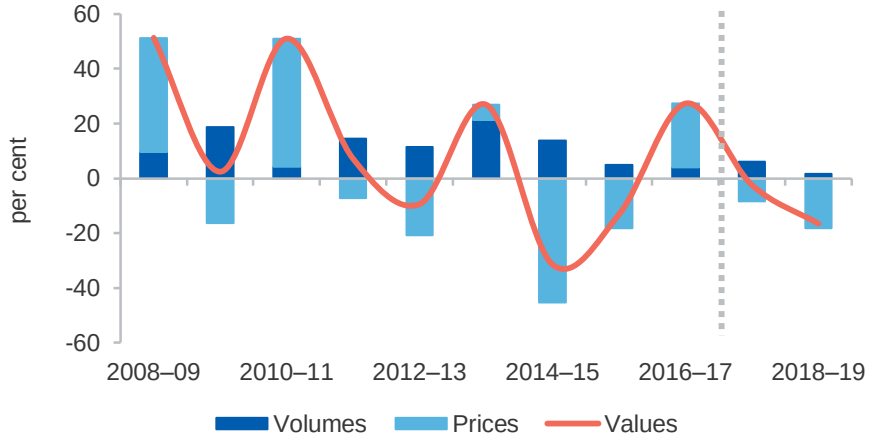
The forecast for Australia's iron ore export values in 2017–18 has been revised up by $2.5 billion from the September 2017 *Resources and Energy Quarterly*. The revision reflects an upwards adjustment to the forecast iron ore price in the first half of 2018, with some short-term support expected from persistently high steel prices, and upwards revisions to production growth at several operations. The value of Australia's iron ore exports in 2018–19 has been revised down by $1.9 billion from the September 2017 *Resources and Energy Quarterly*, as a result of minor downwards revisions to production forecasts to reflect new production guidance for several operations. An upward revision to the AUD-USD exchange rate also contributed to the downward revision of export earnings.

Figure 4.5: Australia's iron ore export volumes and values



Source: ABS (2017) International Trade, Australia, 5454.0; Department of Industry, Innovation and Science (2017)

Figure 4.6: Annual growth in Australia's iron ore export values, and contributions from prices and export volumes



Source: ABS (2017) International Trade, Australia, 5454.0; Department of Industry, Innovation and Science (2017)

Table 4.1: World trade in iron ore

World trade in iron ore	Unit	2016 s	2017 f	2018 f	2019 f	Annual percentage change 2017 f	2018 f	2019 f
World trade	Mt	1,536	1,573	1,604	1,630	2.4	2.0	1.6
Iron ore imports								
European Union 28	Mt	147	152	157	158	3.1	3.0	0.9
Japan	Mt	130	126	132	133	-3.2	4.5	0.9
China	Mt	1,025	1,048	1,049	1,051	2.3	0.1	0.1
South Korea	Mt	72	74	78	79	3.8	4.7	1.9
India	Mt	4	6	11	13	58.3	96.9	12.3
Iron ore exports								
Australia	Mt	808	834	880	894	3.2	5.4	1.7
Brazil	Mt	374	384	400	424	2.6	4.2	6.0
India	Mt	22	28	12	12	30.0	-57.5	0.0
Ukraine	Mt	39	47	47	48	20.4	0.3	2.5

Notes: **s** Estimate; **f** Forecast

Source: World Steel Association (2017); International Trade Centre (2017); Department of Industry, Innovation and Science (2017)

Table 4.2: Iron ore outlook

						Annual percentage change		
World	**Unit**	**2016**	**2017 f**	**2018 f**	**2019 f**	**2017 f**	**2018 f**	**2019 f**
Prices bc								
– nominal	Mt	53.5	64.3	52.6	48.8	20.2	-18.3	-7.2
– real d	Mt	54.6	64.3	51.5	46.7	17.7	-20.0	-9.2
Australia	**Unit**	**2015–16**	**2016–17**	**2017–18 f**	**2018–19 f**	**2016–17 s**	**2017–18 f**	**2018–19 f**
Production								
– Steel hs	Mt	5.00	5.35	5.28	5.28	6.8	-1.1	0.0
– Iron ore	Mt	836.0	872.4	909.9	924.2	4.4	4.3	1.6
Exports								
Steel	Mt	0.77	1.00	0.95	0.98	30.2	-5.0	3.7
– nominal value	A$m	598	875	761	743	46.3	-12.9	-2.4
– real value hi	A$m	620	893	761	727	43.9	-14.7	-4.6
Iron ore	Mt	785.8	818.2	868.9	883.0	4.1	6.2	1.6
– nominal value	A$m	47,799	62,689	62,039	52,231	31.2	-1.0	-15.8
– real value i	A$m	49,616	63,979	62,039	51,069	28.9	-3.0	-17.7

Notes: **b** fob Australian basis; **c** Spot price, 62 per cent iron content basis; **d** In 2017 US dollars; **h** Crude steel equivalent; Crude steel is defined as the first solid state of production after melting. In ABS Australian Harmonized Export Commodity Classification, crude steel equivalent includes most items from 7206 to 7307, excluding ferrous waste and scrap and ferroalloys;
i In 2017–18 Australian dollars; **f** Forecast; **s** Estimate

Source: ABS (2017) International Trade in Goods and Services, Australia, 5368.0; Bloomberg (2017) Metal Bulletin; World Steel Association (2017); AME Group (2017); Company Reports; Department of Industry, Innovation and Science (2017)

Metallurgical coal

Resources and Energy Quarterly December 2017

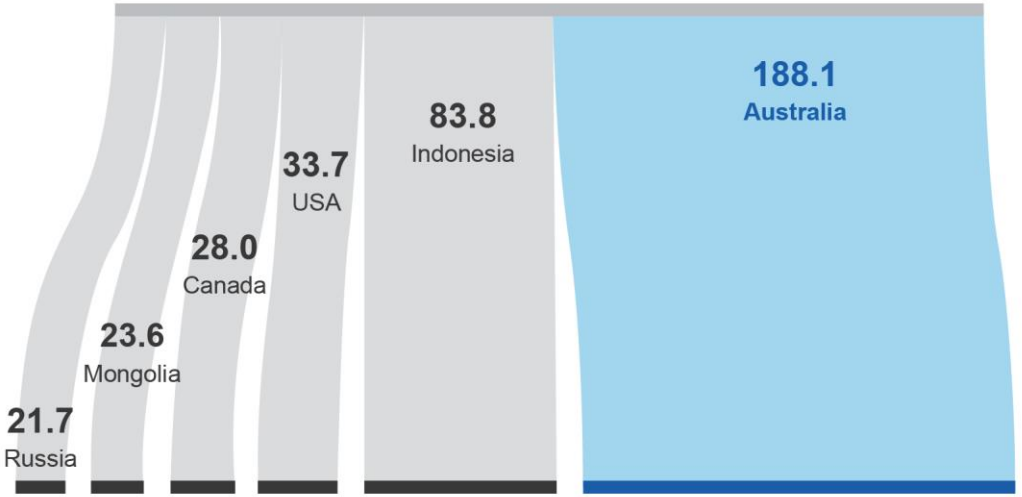
98%
Australia's metallurgical coal production is exported

188.1
million tonnes exported in 2016

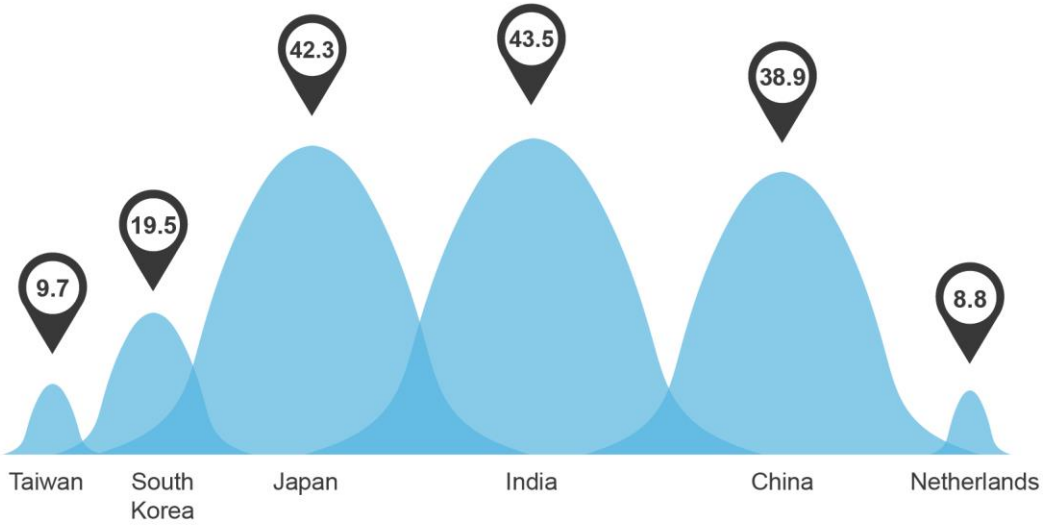
18%
of world metallurgical coal production is in Australia

1st
Australia is the largest exporter of metallurgical coal the world

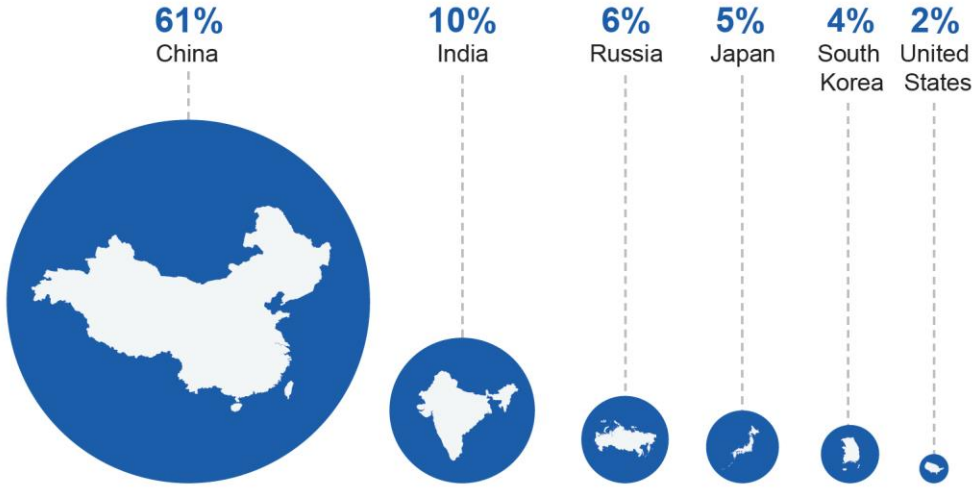
Major metallurgical coal exporters (million tonnes), 2016



Australian metallurgical coal importers (million tonnes), 2016



Largest consumers, 2016



5.1 Summary

- Metallurgical coal prices have been relatively steady in recent months, after a year of wild swings due to supply problems and strong demand.
- Chinese demand has held up in the face of the high prices of recent months, as some steel mills bought ahead of the winter curtailment.
- Supply is steadily recovering, and expansions are expected in 2018.
- In 2017–18, Australian metallurgical coal exports are forecast to be 192 million tonnes, and then rise to 192.5 million tonnes in 2018–19.

5.2 Prices

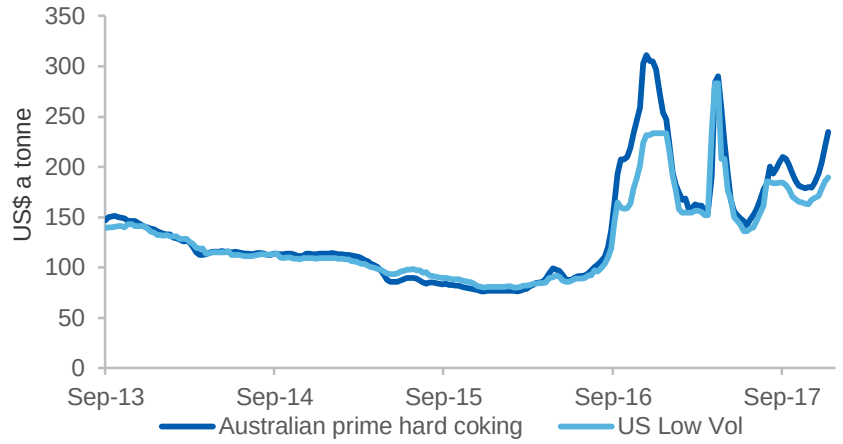
Prices stopped declining, as high demand added to new supply concerns

After a September quarter rally, the Australian Prime Hard Coking Coal (HCC) FOB spot price steadied in a relatively narrow (US$178–242 a tonne) range as 2017 ended. Australian Prime HCC is estimated to have averaged US$186 a tonne in 2017, up 29 per cent. Price strength derived from strong demand and concerns over supply (arising mainly from bottlenecks in the Australian export system). US metallurgical coal prices stayed below Australian prices, helping to cap the latter.

The winter curtailment of a significant amount of Chinese steel capacity is expected to take its toll on metallurgical coal prices as the year turns. Rising supply — due to the return of previously idled capacity and new project supply — is forecast to see prices fall as 2018 matures. However, spot metallurgical coal prices are expected to hold above the US$77–135 a tonne range experienced during from the start of 2014 until mid 2016.

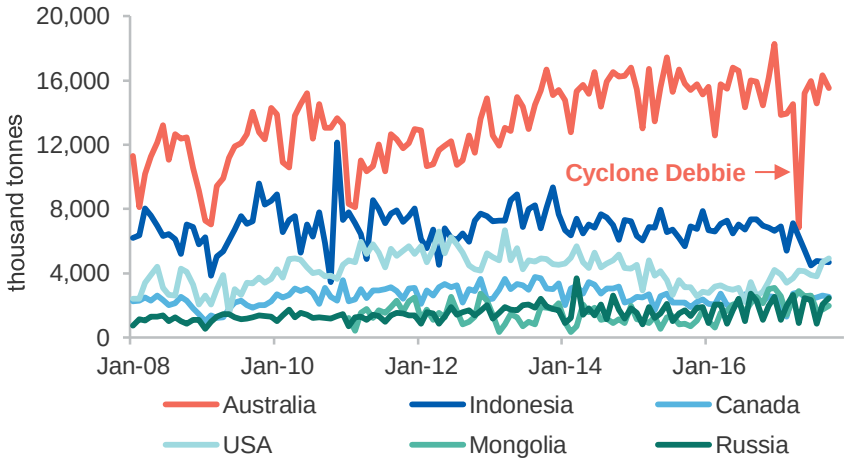
Carrying on the practice recently adopted, quarterly contract pricing for Prime HCC continues to use the prior three-month average of three independent prime HCC spot assessments. The December quarter 2017 price equated to a benchmark price of US$192 a tonne. The Australian benchmark contract price is forecast to drift lower in the next eighteen months (to end 2018–19), as the impact of rising supply more than offsets firm demand.

Figure 5.1: Metallurgical Coal Prices — Australian Prime Hard vs US Low Vol, FOB



Source: IHS Markit (2017)

Figure 5.2: Major metallurgical coal exporters



Source: IHS Markit (2017)

5.3 World trade

World metallurgical coal trade is estimated to grow noticeably in 2018, as the market recovers from the supply disruptions of 2017. In 2019, trade is expected to expand further, but not at the same rate as in 2018. Australian exports should recover from the impacts of Cyclone Debbie and seismic events at the Appin mine, which together appears to have caused the loss of around 10 million tonnes of exports in 2017. A weak La Niña episode is assumed to leave Australian output/exports (which account for over half world exports) largely unscathed in 2018, though there are high risks. China, India, South Korea and Europe will account for the bulk of the rise in metallurgical coal imports, on the back of healthy gains in steel output.

5.4 World imports

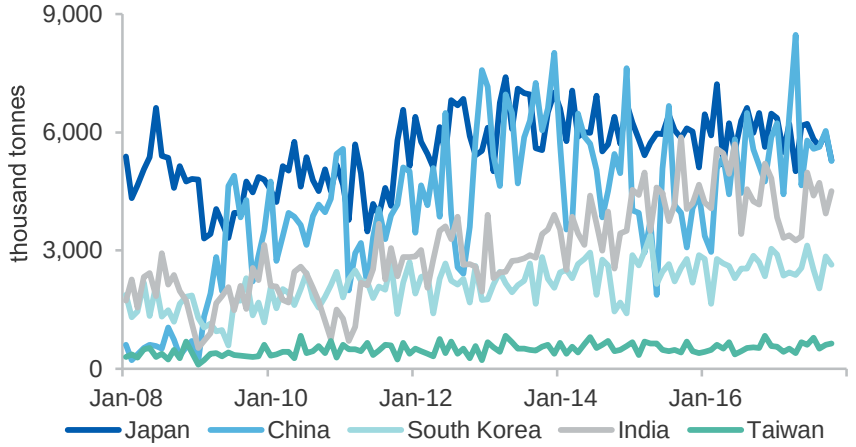
Chinese imports expected to be steady at high levels

In 2017, China is estimated to have imported around 71 million tonnes of metallurgical coal, up from less than 60 million tonnes in 2016. Imports rose as both strong demand from Chinese steel mills and constraints on domestic coal production forced buyers into offshore markets. In mid 2017, four of China's largest metallurgical coal producers voluntarily cut output by one tenth, or about 13–14 million tonnes. Debt levels at major Chinese metallurgical coal miners remain high, and prices need to stay above US$140 a tonne for these miners to clear their way out of trouble.

The curtailment of a significant amount of Chinese steel-making capacity during winter will see some significant seasonal swings in import demand over the forecast period. In 2018, Chinese production of metallurgical coal will (still) be constrained by the impact of ongoing mine safety inspections across Shanxi province. With Chinese metallurgical coal production held down and the price of metallurgical coal in gradual decline (as ex-China supply improves), Chinese steel mills are likely to use any sharp import price dips as an opportunity to re-stock metallurgical coal.

Chinese steel mills ran down metallurgical coal inventories heavily during 2017, and they will be keen to rebuild those inventories, especially if they believe that the current La Niña event weather might hurt Australian metallurgical coal production again.

Figure 5.3: Major Asian metallurgical coal importers



Source: IHS Markit (2017)

Chinese imports of metallurgical coal are thus expected to remain relatively high in 2018 and 2019, with the possibility that China could overtake Japan as the world's largest metallurgical coal importer during that period.

Indian imports to continue their strong rise

Indian imports of metallurgical coal recovered in the second half of 2017, after the price spike brought on by Cyclone Debbie forced Indian steel mills to run down inventories in April-May. Indian steel mills turned to US miners as problems in Australian supply and the price advantage persisted. For the year as a whole, imports are estimated to have risen modestly from 2016.

India continues to ramp up its steel production capacity towards its target of 300 million tonnes per annum by 2025, helping underpin metallurgical coal demand. As part of this plan, India has continued to impose import duties of as much as 20 per cent on a range of steel products.

Indian imports of metallurgical coal are expected to grow significantly in 2018 and 2019, as the domestic coal industry struggles to keep up with strong demand for metallurgical coal from Indian steel mills. Lower metallurgical coal prices will encourage the rise in Indian imports.

South Korean importers have diversified their supply sources

South Korean imports of metallurgical coal are expected to grow in 2018, after a minor gain in 2017. South Korean steel mills were forced to look to Canada, Russia and United States for supply after Cyclone Debbie impacted on Australian exports. South Korean metallurgical coal demand will be boosted by firm growth in domestic steel production. Korean steel production will remain firm, as motor vehicle manufacturers and ship builders look to satisfy firm demand.

Japanese imports declined as prices spiked

Metallurgical coal imports are estimated to have declined modestly in 2017. The decrease in imports came despite some levelling out of the last few years' decline in Japanese steel output. It appears that Japanese steel mills ran down their inventories of inputs as metallurgical coal prices spiked in the wake of Cyclone Debbie.

Japanese steel producers seem to have benefited from the pick-up in domestic economic activity and the broader world economy, as the demand for manufactured goods rises. Business confidence has been strong; a consequent rise in capital spending has been supported by surging corporate profits as well as preparations for the Tokyo Olympics.

Imports of metallurgical coal to Japan are expected to grow modestly in 2018 and 2019. Japanese output of crude steel is expected to continue to recover, as the demand for Japanese motor vehicles picks up further.

5.5 World exports

US exports have surged

It is estimated that seaborne exports of US metallurgical coal reached almost 46 million tonnes in 2017, about 11–12 million tonnes above levels of 2016. But further gains seem unlikely in 2018 and 2019: after years of heavy cost-cutting and widespread bankruptcies, US miners' ability to access finance to fund a further sharp rise in output is in doubt, particularly when their (potential) financiers know that the price spikes of 2016–17 were overwhelmingly the result of temporary, not structural, forces.

Canadian mines re-starting

Canadian exports are estimated to be marginally higher in 2017, but significant gains are likely in 2018 and 2019. Conuma Coal is restarting production at its Wolverine and Willow Creek mines, and Cline Mining's 2.8 million tonnes per annum Donkin project continues to ramp up production from its start in March. In 2018, Jameson Resources' 2 million tonnes per annum Crown Mountain project commences production. As arguably the lowest cost producer among the major exporting nations, Canada is set to remain a significant competitor to Australian producers.

Mongolia exports to China have surged over the past year

Mongolia's January–October metallurgical coal exports to China have increased by almost 30 per cent year-on-year, and accounted for over 37 per cent of China's metallurgical coal imports. Chinese importers stepped up their purchases after Australian metallurgical coal supply was disrupted by Cyclone Debbie. Mongolia is likely to have exported around 25 million tonnes of metallurgical coal in 2017, virtually all of it going to China. With plenty of high quality metallurgical coal reserves, high prices should see exports to China remain strong in 2018 and 2019.

Russian production set to expand strongly

Russian exports of metallurgical coal rose modestly in 2017, as miners struggled to react to the price surge brought on by Australian shortages.

Exports are likely to pick up in strongly in 2018 and 2019, as production at Mechel's Elga operations ramp up to nameplate capacity.

Mozambique becoming a significant exporter

Brazilian miner Vale continued to ramp up output at the Moatize mine in Mozambique in 2017, and is now expected to produce almost 8 million tonnes in 2017. The development of the 18 million tonne per annum Nacala transport corridor has reduced supply chain bottlenecks and been a crucial factor in raising economies of scale and thus reducing costs. Exports from Mozambique are forecast to show strong growth in the forecast period. The ramp up of operations at the Songa and the re-start at the Benga operations will make a significant contribution to this growth, particularly in 2019. However, Mozambique's exports will remain more than half those of Canada, Russia, the United States and Mongolia.

Table 5.1: World metallurgical coal trade

						Annual percentage change		
World	**Unit**	**2016s**	**2017 f**	**2018 f**	**2019 f**	**2017 f**	**2018 f**	**2019 f**
Metallurgical coal imports								
– European Union 28	Mt	40	41	41	42	1.0	1.0	1.0
– Japan	Mt	51	51	53	53	-0.3	3.0	1.0
– China	Mt	59	71	59	53	19.9	-16.6	-10.0
– South Korea	Mt	35	36	37	37	4.0	2.0	1.0
– India	Mt	48	49	50	53	1.5	3.5	5.0
Metallurgical coal exports								
– Australia	Mt	188	177	194	194	-6.4	9.9	-0.4
– Canada	Mt	28	28	29	29	0.9	1.2	1.2
– United States	Mt	34	46	36	35	24.9	-22.0	-3.0
– Russia	Mt	22	24	25	26	9.8	5.0	3.0
World trade	Mt	314	308	315	321	-2.0	2.3	4.5

Notes: **s** Estimate. **f** Forecast.

Source: IEA (2017) Coal Information 2017; Department of Industry, Innovation and Science (2017)

5.6 Australia's production and exports

Australian producers trying to catch up

Australian metallurgical coal production is estimated to have declined modestly in 2017, largely as a result of the impact of Cyclone Debbie in the last days of March. Ongoing operating problems at South32's Appin mine also impacted on Australian metallurgical coal output. Longwall production recommenced at South32's Appin mine in the middle of October, following the completion of extensive remediation work. The company has guided its saleable metallurgical coal output for FY2018 to 3.35 million tonnes, down 41 per cent on FY2017.

There is the potential for fresh disruptions to NSW production of metallurgical coal in the forecast period. While Glencore enterprise agreements covering its Hunter Valley operations have been settled, the threat of industrial action by miners at the Appin mine and rail workers in the Hunter Valley (where some semi-soft coking coal is also produced) remains.

Another threat to production (and thus exports) as 2018 begins is the possibility of wet conditions on the Queensland coast. Late in 2017, meteorologists declared a La Niña weather event. La Niña weather conditions typically bring above-average rainfall to eastern Australia during late spring and summer. However, sea surface temperature patterns in the Indian Ocean and closer to Australia are not typical of a La Niña event, suggesting that it will be weaker than the strong La Niña episode of 2012, and thus there will be a reduced likelihood of widespread above-average summer rainfall.

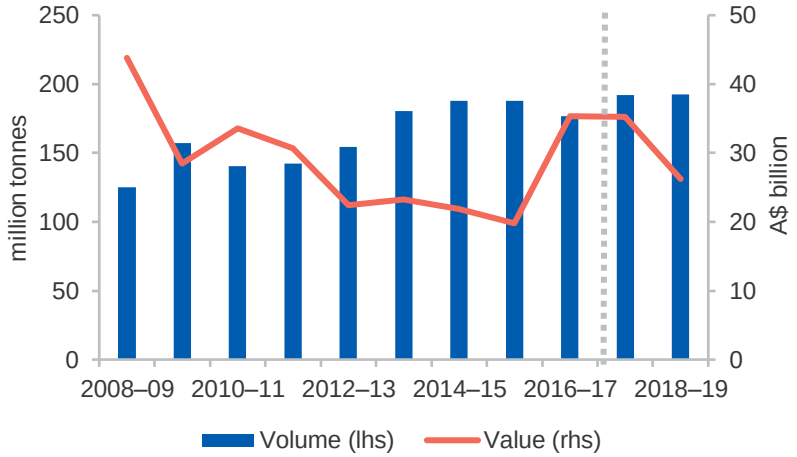
These risks aside, production is expected to grow strongly in 2018 and 2019, as miners respond to high prices and the impact of some of the operational problems (man-made and weather-related) of 2017 fades. Metallurgical coal output should rise from 190 million tonnes in 2017 to 196 million tonnes in 2018 and 2019.

Australian export earnings to hit record high

Australia's metallurgical export volumes are estimated to have declined by 11–12 million tonnes (5–6 per cent) in 2017, to 177 million tonnes. The decline was largely due to export delays associated with the impact (on rail lines) of Cyclone Debbie in late March.

In 2018 and 2019, assuming no major weather-related disruptions, metallurgical coal exports should rebound to around 193 million tonnes, as supply responds to the high prices of the past twelve months or so. Export earnings are set to be unchanged at around $35.3 billion in 2017–18, but then drop by about $10 billion in 2018–19 as metallurgical coal prices fall back.

Figure 5.4: Australia's metallurgical coal export volumes and values



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

Table 5.2: Australia's metallurgical coal outlook

						Annual percentage change		
World	**Unit**	**2016**	**2017 s**	**2018 f**	**2019 f**	**2017 s**	**2018 f**	**2019 f**
Contract prices e								
– nominal	US$/t	114.4	209.6	154.5	125.5	83.2	-26.3	-18.8
– real d	US$/t	116.7	209.6	151.3	120.2	79.5	-27.8	-20.5
Spot prices g								
– nominal	US$/t	143.5	185.9	151.1	119.0	29.5	-18.7	-21.3
– real d	US$/t	146.5	185.9	148.0	114.0	26.8	-20.4	-23.0
Australia	**Unit**	**2015–16**	**2016–17**	**2017–18 f**	**2018–19 f**	**2016–17 s**	**2017–18 f**	**2018–19 f**
Production		189.3	190.0	195.7	196.4	0.4	3.0	0.4
Export volume	Mt	188.0	177.2	192.1	192.5	-5.8	8.4	0.2
– nominal value	A$m	19,790	35,363	35,266	26,213	78.7	-0.3	-25.7
– real value i	A$m	20,566	36,091	35,266	25,602	75.7	-2.3	-27.4

Notes: **d** In 2017 US dollars. **e** Contract price assessment for high-quality hard coking coal. **i** In 2017–18 Australian dollars. **f** forecast. **g** Hard coking coal fob Australia east coast ports. **s** estimate
Source: ABS (2017) International Trade in Goods and Services, Australia, 5368.0; Department of Industry, Innovation and Science (2017); Platts Steel Analyzer (2017)

Thermal coal

Resources and Energy Quarterly December 2017

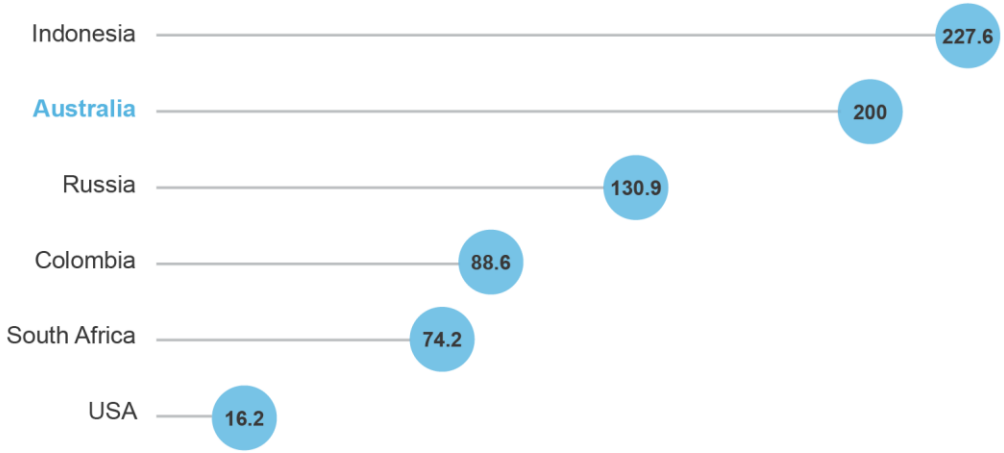
In 2016, **around 5%** of global thermal coal production was in Australia

Australia is the **2nd largest** thermal coal exporter in the world

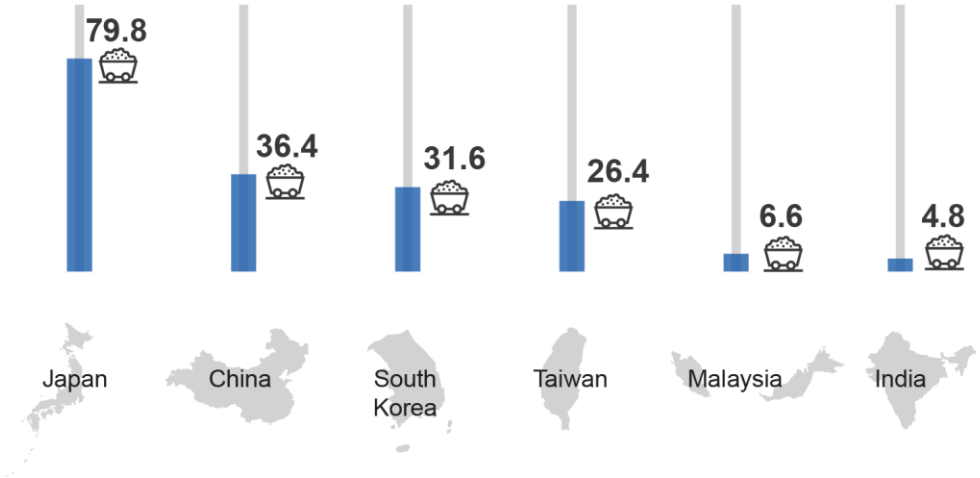
200 million tonnes exported in 2016

Roughly 80% of Australia's thermal coal production is exported

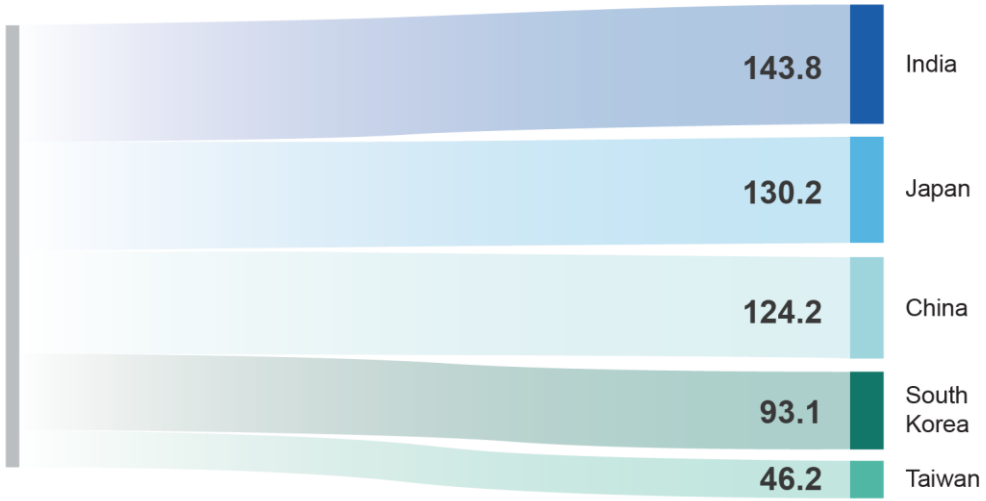
Major thermal coal exporters (million tonnes), 2016



Key importers of Australian thermal coal (million tonnes), 2016



Asian thermal coal imports (million tonnes), 2016



6.1 Summary

- Thermal coal prices have remained at the relatively high levels reached late in the September quarter, at over US$90 per tonne.
- Stronger world demand remains a feature of the market, as the world economic recovery consolidates.
- Supply remains constrained, as China conducts safety inspections and industrial action impacts on Australian output.
- In 2017–18, Australia's exports are forecast to rise marginally from 2016-17, and see further minor gains to 203 million tonnes in 2018–19.

6.2 Prices

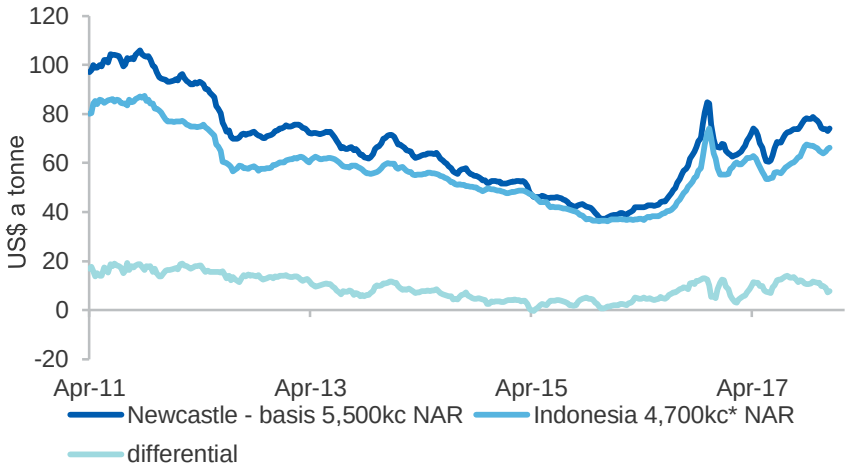
Prices remained high, as strong demand added to supply worries

The October 2017 to September 2018 Japanese contract price settled at US$94.75 a tonne FOB Newcastle, the same as the previous year.

During the December quarter, Newcastle spot prices held at levels reached in late September 2017, at US$95–100 a tonne. Price strength derived from both firm restocking demand and supply concerns. The Newcastle FOB spot price is estimated to have averaged US$87 a tonne in 2017, one third above 2016. The premium of Australian thermal coal to Indonesian coal has stayed relatively wide, encouraging higher purchases of Indonesian coal (often to blend with Australian coal).

Prices are expected to ease through 2018 and early 2019, as supply rebounds and demand moderates. The Newcastle FOB spot price is forecast to drop by 12 per cent to average US$77 a tonne in 2018, and by a further 6 per cent to USD70 a tonne in 2019. The JFY 2018 (April 2018 to March 2019) benchmark contract price is now projected to settle at US$79 a tonne, lower than the JFY 2017 price of US$84 a tonne. This represents an upward revision of US$5 a tonne from the September 2017 *Resources and Energy Quarterly* forecast. The contract price is forecast to be US$74 a tonne in 2019.

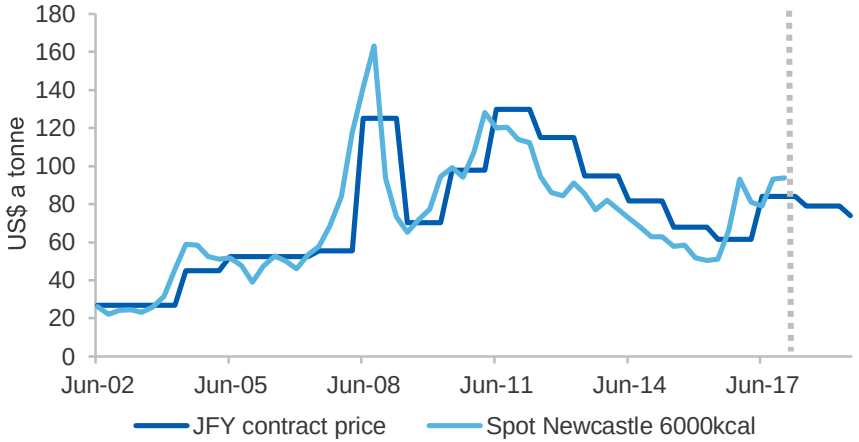
Figure 6.1: Thermal coal prices — Australian versus Indonesian



Notes: Indonesia calorific value basis lowered to 4,700 kc NAR from 4,900 kc NAR, effective week ending 6 May 2016. History is based on pro rata calculation of the previous series

Source: IHS Markit (2017)

Figure 6.2: Australian thermal coal price — spot versus contract



Notes: Spot price is quarterly average of weekly data, contract price is for Japanese Fiscal Year commencing 1 April

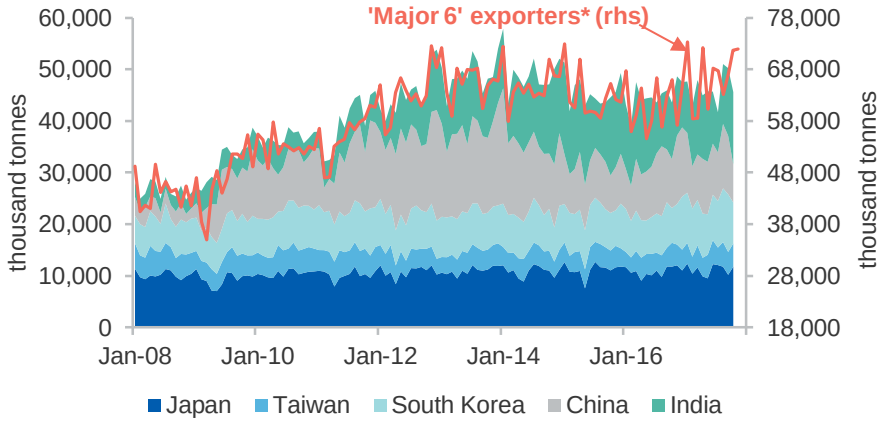
Source: IHS Markit (2017)

6.3 World trade

Following an estimated gain of 1.3 per cent in 2017, world thermal coal trade in 2018 is forecast to increase by 1 per cent to 1.1 billion tonnes. A feature of world trade in 2017 has been the significant rise in imports outside of the major five Asian importing nations. For the past nine years, swings in imports by the major five Asian importers have closely dictated swings in total exports by the major six exporters (Indonesia, Australia, Russia, Colombia, South Africa and the US). However, in 2017 exports by the major six exporters were stronger than imports by the Asian five would have suggested, indicating stronger 'rest of world' demand. The strength in the 'rest of the world' could have contributed to unexpected price strength.

Among the major five Asian importers, there have been signs of a tentative stabilisation in Indian import demand, and a major surge in South Korean imports. On the export side, the recovery in United States exports in late 2016 has held, and Indonesian exports have strengthened noticeably.

Figure 6.3: Major five Asian importers vs major six world exporters



Notes: Major six exporters are Australia, Russia, Indonesia, Colombia, US, South Africa. Data is previous month's exports.

Source: IHS Markit (2017)

6.4 Imports

Strong Asian import demand appears set to continue

Thermal coal import demand has recently been driven by China, India, South Korea, and to a lesser extent Vietnam, Pakistan and the Philippines. Inventories in China and India have been low in seasonal terms, which has seen firm import demand from those nations as winter peaks.

Chinese imports rose modestly in 2017, as safety checks impacted

After Government-induced production cutbacks in the middle of 2016, Chinese thermal coal production in 2017 was adversely impacted by rolling mine safety inspections. The resultant low coal output helped raise imports, though buying has recently become much more sporadic — as it has in India — as prices hit levels that importers deem too high. Strong hydro power output in the latter half of 2017 allowed power generators to pare coal-fired output. Imports suffered, as customs conducted more stringent checks in ports in south China, delaying cargoes.

The Chinese authorities remain committed to reducing losses by state-owned coal miners. To that end, there remains a commitment at varying domestic output in order to try to keep prices at levels where Chinese power utilities have "acceptable" profit margins.

The Chinese authorities appear intent on limiting thermal coal burn, particularly in the regions where air pollution is at its worst. However, more than half of China's massive coal-fired fleet is less than 10 years old and can/will not be quickly replaced. Accordingly, over the forecast period (to end 2018–19) and beyond, the emphasis will be on importing high energy/low ash coal. This trend will favour Australian miners at the expense of Indonesian miners, though any major move in the price differential will see changes in Chinese blending, in order to optimise the price/energy trade off.

Japanese imports rose modestly in 2017

Japanese imports are estimated to have risen modestly in 2017, as a steady economic recovery helped boost power demand. With the vast majority of the nuclear power industry remaining 'grounded', utilities continue to rely on coal to help fill the gap. Thermal coal imports are unlikely to show substantial growth in the next two years: Japan will continue to bring its nuclear power fleet back on line very slowly, and renewables are expected to provide a rising source of energy for Japan's power needs.

Indian imports fell as production improved and stocks were run down

Indian imports declined in 2017 compared to 2016, as domestic output rose and inventories were run down after the end of the winter. Coal India has been successful in raising output modestly, though it looks unlikely to go close to meeting its 600 million tonne target for Indian financial year 2017-18. Production by Central Coalfields, a Coal India unit, was disrupted by unprecedented rains, and the closure of the Dhanbad-Chandrapura railway line (because of safety concerns) also disrupted supply.

For 2017 as a whole, Indian imports from Indonesia are estimated to have been little changed from 2016, but there were significant falls in imports from South Africa and Australia. In the latter half of 2017, inventories at power plants were run down to reach their lowest level (in absolute terms) this decade, suggesting that inventories are extremely low relative to consumption. In the next year or so, imports will likely rebound modestly: with inventories very low, domestic coal output is unlikely to keep pace with rising power demand. A ban on petcoke in the National Capital Region in November 2017 will also act to boost thermal coal imports.

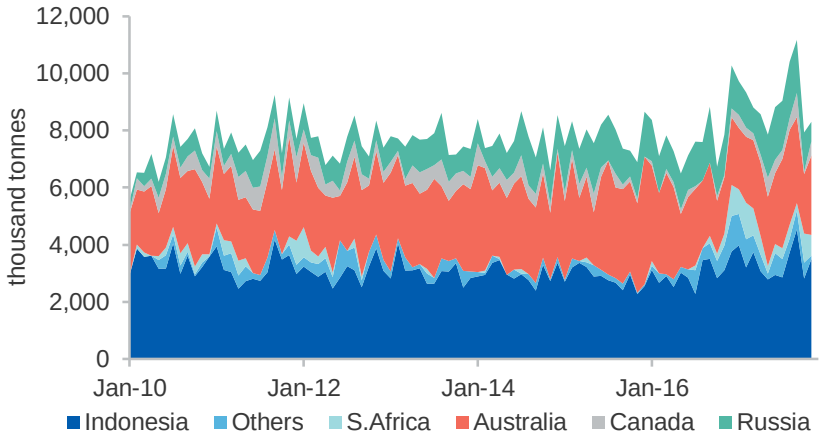
The Indian Government remains intent on increasing the portion of renewable energy in the country's power mix. However, it seems that the demand for power will rise at a faster pace than the rate at which renewable capacity can be built — see Box 6.1 on the next page. The Indian government is left relying on increased domestic production (of low energy, high ash thermal coal) and or/higher imports.

South Korean imports jumped in 2017

South Korea's thermal coal imports have shown high volatility in recent months, but have averaged levels noticeably higher than in 2016. Driving the gains has been buying by coal-fired power generators, as nuclear reactor outages bite into the country's energy supply. In 2017, imports are estimated to have risen by around 20 per cent on 2016.

South Korean demand should remain solid in 2018 and 2019, as the introduction of new coal-fired power capacity outpaces capacity being retired or temporarily closed. Imports will move towards higher quality (high energy, low ash) coal, as the government uses (further hikes in) the coal consumption tax and moral suasion to push generating companies to limit air pollution. Australia, Colombia and Russia should benefit at Indonesia's expense.

Figure 6.4: South Korean thermal coal imports



Source: IHS Markit

Box 6.1: World Energy Outlook 2017: Coal

The World Energy Outlook 2017 released in November 2017 constructed three scenarios to help frame forecasts of world energy usage to 2040. In the 'New Policies Scenario' incorporating policies adopted or promised, while global GDP grows by 3.4 per cent a year on average over the next 25 years, coal demand growth levels off. However, the global trend masks some stark regional differences. Many high-income nations, often with flat energy demand and an economic growth model that relies to a large degree on services, choose to phase out coal use for environmental reasons. However, lower income nations at an earlier stage of their economic development typically need to satisfy fast growing energy demand, fueled in part by rapid population growth.

The International Energy Agency projections suggest that as China's policy efforts to foster the economic contribution of the service sector and decrease reliance on the heavy industries bear fruit, the country will gradually join the group of countries that see their coal demand decline over the projection period. Although China's coal demand peaked in 2013, it takes time to achieve deep cuts in coal consumption. Only in the latter half of the Outlook period does China's coal demand drop markedly, resulting in an overall decrease in coal use of some 13 per cent over the next 25 years. Coal demand in India more than doubles over the period to 2040, while in Southeast Asia it grows almost two-and-a-half times. This contrasts with a drop in coal usage by 2040 of over 60 per cent in the EU, more than 30 per cent in Japan, and around 10 per cent in the US.

Coal's share of world power output falls from 37 per cent today to about a quarter in 2040, as renewables continue their ascent and become the number one source of power generation in the mid-2020s. Electricity generation from coal rises by some 10 per cent through 2040, but coal burn in the power sector hardly gains, a clear sign that the world's coal fleet becomes more efficient. 75 per cent of the 880 GW of new coal plant entering into service over the next 25 years uses either supercritical (440 GW) or ultra-supercritical technology (235 GW), bringing down the share of the less efficient subcritical plants in the global coal fleet from over 60 per cent in 2016 to less than 40 per cent in 2040.

China remains the world's largest coal producer throughout the projection period while India, currently the 4th largest producer, overtakes the US (and Australia) in the early 2020s to become the 2nd coal producer. The share of steam coal rises from around 75 per cent now to over 80 per cent in 2040, as coking coal output declines from 967 Mtce in 2016 to 805 Mtce in 2040 (and lignite output drops from 255 Mtce to 230 Mtce). The drop in coking coal production is mostly due to China moving away from the basic-oxygen furnace in steel production. Export-oriented coal producers like Australia, Russia or Mozambique manage to expand their coking coal production over the next 25 years, primarily targeting rapidly growing steel producers like India.

In the past two years, coal trade has declined slightly after tripling in the previous 25 years. In the New Policies Scenario, coal trade does not grow: in 2040, trade volumes are still below 2015 levels. However, the global trend masks stark regional variations and some differences between types of coal. Coal imports decline in advanced economies like the European Union, Japan and Korea. They also decline in China, which in 2016 was the biggest coal importer in the world. Imports continue to play an important balancing role during China's coal industry restructuring process, but this process is assumed to be largely accomplished by the mid-2020, and China's need for coal imports therefore declines. By 2040, Chinese coal imports have dropped to 70 Mtce, down from almost 200 Mtce in 2016. The declines are offset by rises in other parts of the world, notably India and Southeast Asia. In India, imports are forecast to resume growing from the early 2020s, and increase through to 2040. India thus becomes the world's largest importer, buying over 235 Mtce in 2040 – a 45 per cent rise on 2016 import levels. Three-quarters of the increase in imports comes from coking coal. Similarly, fast growing and price sensitive economies like Vietnam, Pakistan, Malaysia, Thailand the Philippines and Pakistan increasingly turn to coal imports to meet their energy needs.

Source: *International Energy Agency (2017), World Energy Outlook 2017, OECD/IEA, Paris*

6.5 Exports

Indonesian exports bounced back in 2017

Indonesian thermal coal exports rose noticeably right through 2017, as the higher prices of the past year encouraged increased production, reaching over 450 million tonnes. Going forward, Indonesian government officials have indicated that local miners will have to meet stricter environmental and safety requirements before the government approves requests to increase future production. The government also wants to limit total coal output at 400 million tonnes a year from 2019 onwards, in order to support Indonesia's future energy security. National output however, has historically exceeded the government's targets.

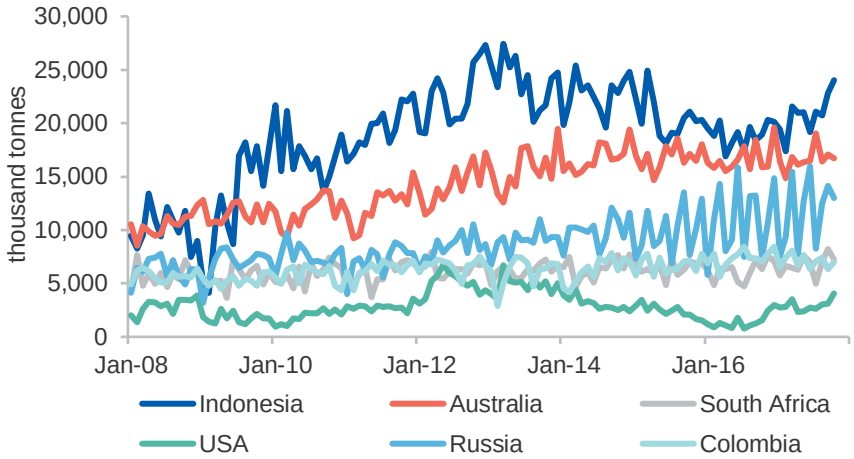
Russian exports hurt by falling European coal consumption

In trend terms, Russian exports increased modestly in the last part of 2017, as a surge in exports to Ukraine was largely offset by lower demand from the United Kingdom and Germany. With Western European nations looking to reduce thermal coal consumption, Russian miners are increasingly looking to supply India and South East Asian countries, by tapping coal deposits in the country's east. A few projects are already under development, such as the Amaam and Elga projects. As low-cost producers, Russian miners are expected to continue to compete strongly for increased market share in the outlook period.

US exports maintained their recovery of late 2016

US exports held at relatively high levels in the last part of 2017. US seaborne exports of thermal coal in 2017 are likely to have been around 34 million tonnes, roughly double 2016 exports of 16.2 million tonnes. Increased Asian and European demand helped US miners, a large portion of whom were still recovering from the impacts of major financial restructurings that occurred in 2016.

Figure 6.5: Thermal coal exports by major exporters



Source: IHS Markit

The global appetite for US (high-sulphur) coal exports has been growing, with buyers blending it with Russian low sulphur coal. Some buyers have fewer concerns about sulphur content, such as cement and brick makers.

In 2018, US exports are likely to hold at relatively high levels compared to 2016. US exports are likely to gradually drop back from around the end of 2018, in response to a steady decline in global thermal coal prices in 2018.

South African labour unrest less of a threat in 2018 and 2019

South African exports have been firm in recent months, helped by strong demand from India and, to a lesser extent, South Korea. The threat of widespread industrial action in the South African coal industry has also seen Indian importers snapping up South African cargoes as a precautionary measure. With better quality coal than Indonesia, South Africa can benefit from India's gradual push towards using cleaner coal. Major mining companies remain reluctant investors in the South African industry, and transportation in that nation remains a major problem.

Colombian exports have been impacted by bad weather

Exports are estimated to have decreased by 1–2 per cent in 2017. Glencore's and Cerrejón's operations were affected by heavy rain (in the middle of the year) and lower mining equipment availability. Colombia remains one of the world's lowest-cost producers, however, the distance to Asia remains a major problem for Colombian exporters, as demand wanes in both Europe and the Americas.

Australia's exploration, production and trade

Australian coal exploration remains low, though with growth in Queensland

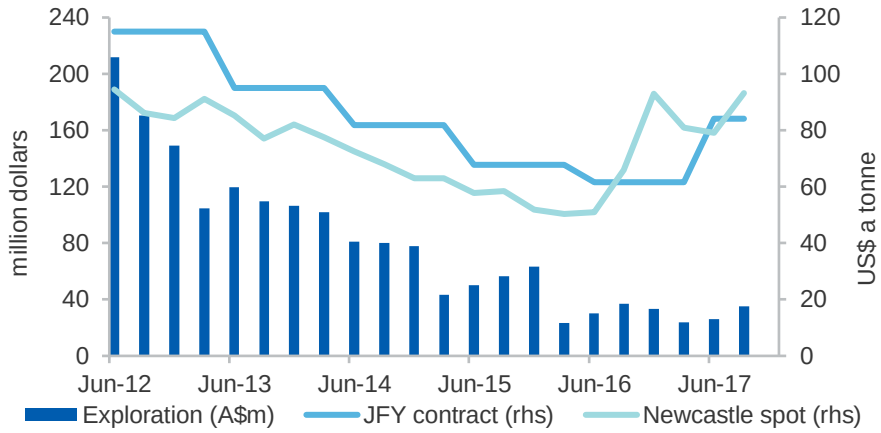
Australia's coal exploration expenditure remains relatively modest, with $35.1 million invested in the September quarter. This is about one third higher than in the June quarter, but virtually unchanged through the year. The quarterly rise was driven by higher exploration in Queensland, which now accounts for more than 80 per cent of all coal exploration. Coal exploration spending peaked in the September quarter of 2011 (when $227 million was spent), but has been progressively pegged back amidst falling coal prices and oversupply in low grade thermal coal markets.

Australian production has been impacted by industrial action

Australian production has been slightly impacted by industrial action in 2017–18. With prices hitting multi-year highs, and a firm demand outlook, Australian producers are attempting to raise production. Provided industrial disputes do not escalate, it is likely that production will show significant growth in 2018 and early 2019, before flattening out. Production is forecast to be around 249 million tonnes in 2017–18, down fractionally from 250 million tonnes in 2016–17.

In 2018–19, production is forecast to increase by 2 per cent to 254 million tonnes. Output is expected to be boosted by the ongoing expansions at Rolleston and at a significant number of mines in the NSW Hunter Valley region, including Ravensworth.

Figure 6.6: Australia's coal exploration expenditure



Source: ABS (2017) Mineral and Petroleum Exploration, cat. no. 8412.0; Department of Industry, Innovation & Science (2017)

Australian exports impacted by transport problems and industrial action

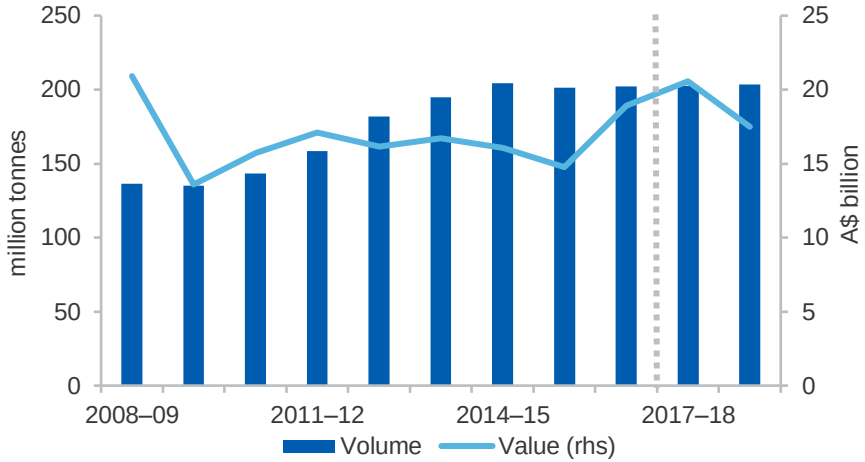
Australian exports in 2017 are estimated to have been little changed from 2016, as industrial action, transport disruptions and bad weather impacted on producers who were urgently attempting to respond to the price surge of 2016 and early 2017.

Union workers at Australian freight provider Pacific National's New South Wales unit held two 48-hour strikes at consecutive weekends from 21st October, escalating their industrial dispute over negotiations surrounding a new collective workplace agreement. The industrial action resulted in the cancellation of 180 trains from Hunter Valley to Newcastle Port, and impacted roughly 1.5 million tonnes of coal deliveries. Ongoing industrial unrest at Glencore's operations also had an impact on production and exports in the last few months of 2017.

Australian producers with high energy and low ash coal will tend to take share from local/overseas producers of lower quality coal, as countries such as China, South Korea and Taiwan look to reduce air pollution, particularly during their winter months.

Australian's thermal coal export earnings are forecast to rise by 7.7 per cent in 2017–18, to $20.4 billion. In 2018–19, thermal coal export revenues are expected to be $17.5 billion: lower prices achieved for Australia's thermal coal exports will more than offset the impact on earnings of modestly higher export volumes.

Figure 6.7: Australia's thermal coal export volumes and values



Source: Australian Bureau of Statistics, Department of Industry, Innovation and Science (2017)

Table 6.1: Thermal coal outlook

World	Unit	2016	2017 s	2018 f	2019 f	Annual percentage change 2017 f	2018 f	2019 f
Contract prices b								
– nominal	US$/t	62	84	79	74	36.4	-6.0	-6.3
– real c	US$/t	63	84	77	71	33.5	-8.1	-8.6
Spot prices d								
– nominal	US$/t	65	87	77	70	33.2	-11.6	-9.4
– real e	US$/t	67	87	75	67	30.4	-13.4	-11.4
Coal trade	Mt	1,045	1,058	1,038	1,014	1.3	-1.9	-2.3
Imports								
Asia	Mt	759	759	760	751	-0.1	0.1	-1.1
China	Mt	196	200	198	184	2.0	-1.0	-7.0
Chinese Taipei	Mt	59	63	66	67	7.0	4.0	2.5
India	Mt	166	141	137	135	-15.0	-3.0	-1.0
Japan	Mt	138	141	142	143	2.0	1.0	0.5
South Korea	Mt	100	106	104	104	6.5	-2.0	-0.5
Europe	Mt	214	204	189	176	-5.0	-7.0	-7.0
European Union 27	Mt	163	155	144	134	-5.0	-7.0	-7.0
other Europe	Mt	51	49	45	42	-5.0	-7.0	-7.0
Exports								
Australia	Mt	202	201	203	202	-0.6	0.9	-0.5
Colombia	Mt	82	82	84	88	-0.1	2.0	5.0
Indonesia	Mt	369	374	367	354	1.5	-2.0	-3.5
Russia	Mt	144	151	153	155	5.0	1.1	1.3
South Africa	Mt	75	76	76	78	1.0	-0.2	2.6
United States	Mt	18	33	27	25	90.0	-20.0	-5.0
Australia	**Unit**	**2015–16**	**2016–17**	**2017–18 f**	**2018–19 f**	**2016–17**	**2017–18 f**	**2018–19 f**
Production	Mt	250.4	250.0	248.8	254.1	-0.2	-0.5	2.1
Export volume	Mt	201.3	201.7	204.3	203.3	0.2	1.3	-0.5
– nominal value	A$m	14,751	18,903	20,360	17,492	28.1	7.7	-14.1
– real value h	A$m	15,312	19,292	20,360	17,084	26.0	5.5	-16.1

Notes: **b** Japanese Fiscal Year (JFY), starting April 1, fob Australia basis. Australia–Japan average contract price assessment for steaming coal with a calorific value of 6700 kcal/kg gross air dried; **c** In current JFY US dollars; **d** fob Newcastle 6000Kcal; **e** In 2017 US dollars; **f** Forecast; **g** Includes lignite; **h** In 2017–18 Australian dollars

Source: ABS (2017) International Trade in Goods and Services, Australia, Cat. No. 5368.0; IHS Inc; IEA 2015 Coal Information; Coal Services Pty Ltd; Queensland Department of Natural Resources and Mines; Company Reports; Department of Industry, Innovation and Science.

Gas

Resources and Energy Quarterly December 2017

LNG is natural gas cooled to

–162°C

2nd

largest LNG exporter in the world

52 million tonnes

of LNG exported in 2016–17

41%

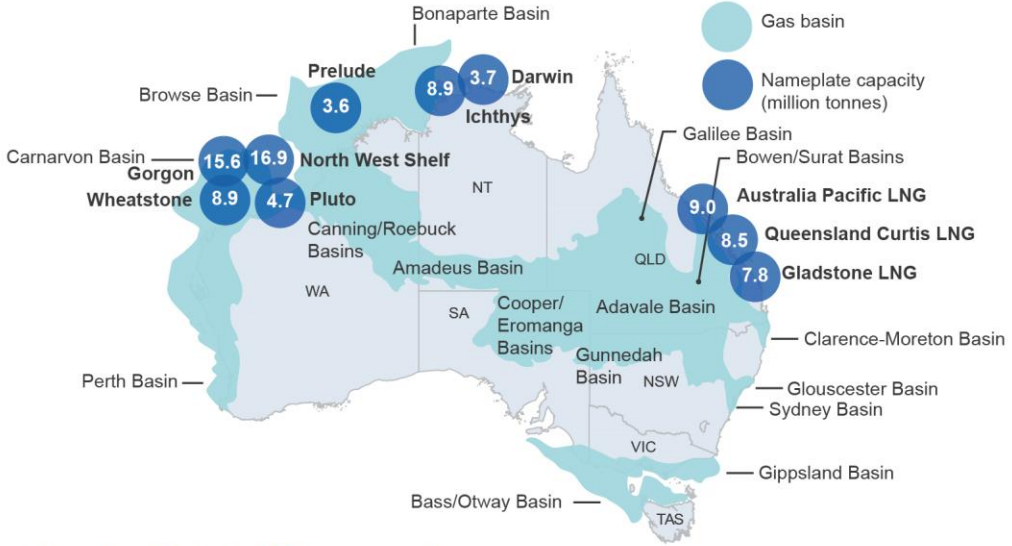
rise from 2015–16 in export volumes

Combined nameplate capacity of Australia's 10 LNG projects is

88 million tonnes per annum

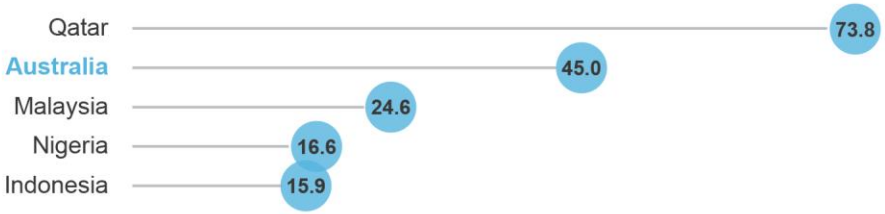
Most Australian LNG is sold on oil-linked contracts

Australia's LNG projects and gas basins



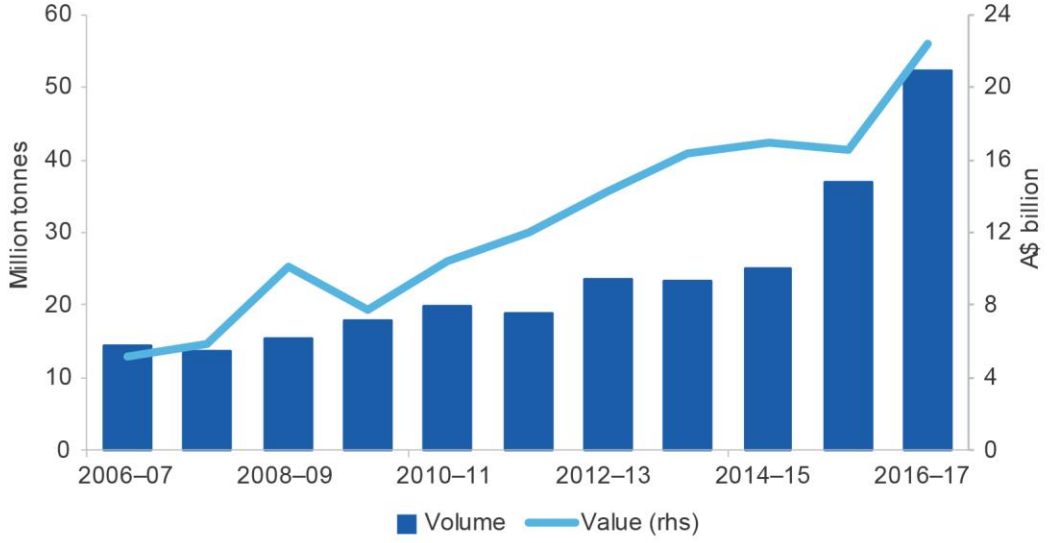
Largest LNG exporters and importers, 2016

Largest exporters (million tonnes)



Largest importers (million tonnes)

Australia's LNG exports



7.1 Summary

- The value of Australia's LNG exports is forecast to increase from $22 billion in 2016–17 to $36 billion in 2018–19, driven by higher export volumes and, to a lesser extent, higher prices.
- The completion of the final three Australian LNG projects under construction will underpin strong growth in export volumes and bring annual export capacity to 88 million tonnes.
- LNG contract prices — under which most Australian LNG is sold — are forecast to increase in line with oil prices. High LNG spot prices in Asia are likely to be attractive to Australian exporters in the short-term, but are expected to decline from their present level.
- LNG is forecast to overtake metallurgical coal as Australia's second largest resource and energy export in 2018–19.

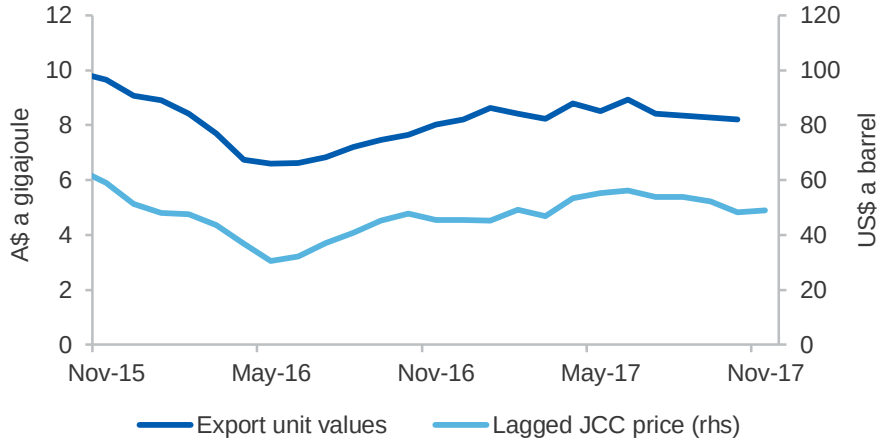
7.2 Prices

LNG contract prices to rise and spot prices to fall

The average price of Australian LNG (FOB) has edged down over the past few months. The average price was around $8.20 a gigajoule — around US$6.80 per million British thermal units (MMbtu) — in October (the latest available data). Recent price movements are a result of weakening oil prices over the middle of 2017. The majority of Australian LNG is sold on long-term contracts linked to the price of Japan Customs-cleared Crude (JCC) oil lagged by around three months.

LNG spot prices in Asia have risen sharply in recent months, driven by unplanned outages at a number of LNG facilities and strong pre-winter buying by key buyers in Asia (particularly China). The price spike has taken Asian spot prices above oil-linked contract prices. As Figure 7.2 shows, LNG spot prices (Delivered Ex Ship) averaged $11.90 a gigajoule in November (US$9.60 per MMbtu) while an indicative price for LNG on a long-term oil-linked contract (Delivered Ex Ship) was around $9.10 a gigajoule (US$7.30 per MMbtu).

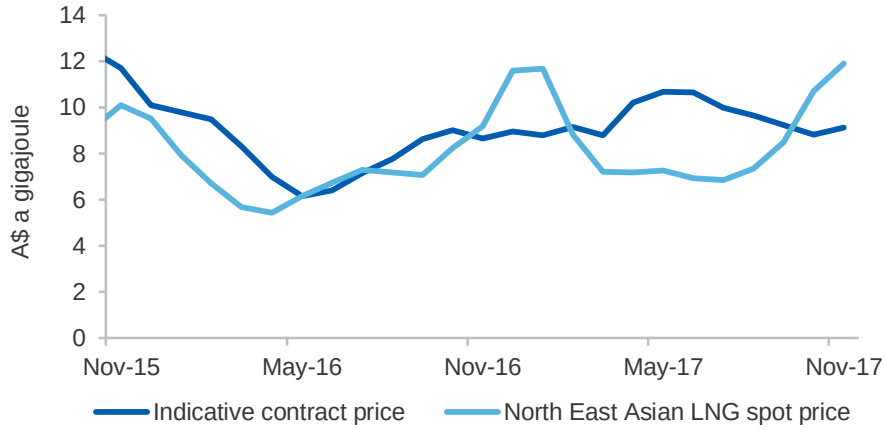
Figure 7.1: Recent movement in export unit values, monthly



Notes: the Japan Customs-cleared Crude (JCC) price is lagged three months.

Source: ABS (2017); Bloomberg (2017)

Figure 7.2: LNG contract price versus spot price, DES, monthly



Notes: the contract price shown here is indicative only and is estimated as 14 per cent of the three-month lagged JCC price plus shipping. DES stands for Delivered Ex Ship. DES LNG includes the cost of shipping and insurance.

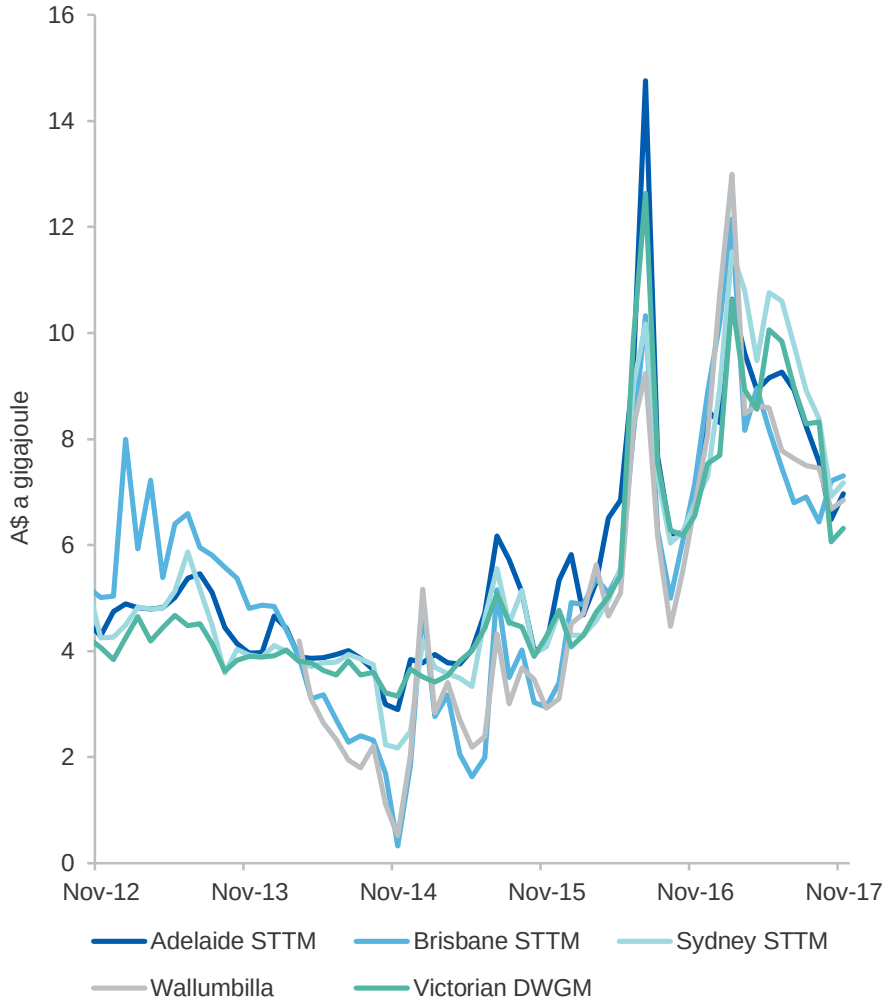
Source: Argus (2017); Bloomberg (2017)

The price of Australian LNG (FOB) is forecast to increase to average $9.0 a gigajoule in 2018–19, largely driven by higher prices on oil-linked contracts. The recent increase in oil prices should begin to flow through to Australian LNG prices around early 2018. The JCC oil price is forecast to average US$56 a barrel in 2018–19, up from an average US$50 a barrel in 2016–17. The recent increase in Asian LNG spot prices should also support average Australian LNG prices in the short-term, as exporters look to capitalise on the price spike.

However, LNG spot prices in Asia are forecast to decline from present levels, as the tightness in the market generated by northern winter buying unwinds. In 2018, Asian LNG spot prices (Delivered Ex Ship) are forecast to average $8.30 a gigajoule (around US$6.50 per MMbtu). In 2019, LNG spot prices are forecast to fall to $6.70 a gigajoule (around US$5.40 per MMbtu), as additions to global supply capacity outstrip growth in LNG demand.

Domestic wholesale spot prices in Australia's eastern gas market have not followed recent movements in Asian LNG spot prices, having continued to decline since mid-2017. Spot prices on the east coast averaged $6–7 a gigajoule in November, below netbacks from both Asian LNG spot prices and oil-linked contract prices. The Appendix at the end of this chapter discusses the relationship between domestic spot prices and LNG netbacks.

Figure 7.3: Domestic wholesale gas spot prices on the east coast, monthly



Notes: Wallumbilla is a gas supply hub. STTM stands for Short Term Trading Market. DWGM stands for Declared Wholesale Gas Market.

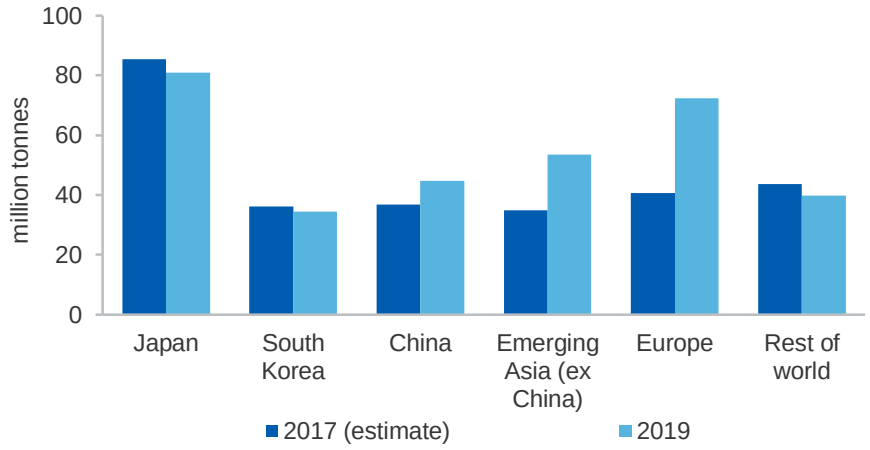
Source: AEMO (2017)

7.3 World trade

World LNG imports are forecast to increase from 250 million tonnes in 2016 to 326 million tonnes in 2019. Emerging Asia — led by China — and Europe are expected to drive demand growth (Figure 7.4). Prospects for growth in the imports of the world's two largest consumers — Japan and South Korea — are more limited. Supply growth will be supported by a major expansion of LNG export infrastructure, primarily in the United States and Australia.

In 2018, demand growth is expected to keep pace with additions to global liquefaction capacity. An improved demand outlook, coupled with delays to the completion of a number of LNG projects, appear to have postponed the arrival of overcapacity in LNG markets. However, by 2019, LNG demand growth is expected to be outpaced by additions to world supply capacity. Consequently, the average capacity utilisation of LNG plants is expected to fall.

Figure 7.4: LNG import forecasts



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

7.4 World imports

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

After a strong start to the year, Japan's LNG imports contracted sharply between August and October following the restart of two nuclear reactors. Four of Japan's fleet of 42 reactors (combined capacity 3.5 gigawatts) are currently operational. Japan's LNG imports are estimated to have remained little changed in 2017 at 86 million tonnes.

By 2019, Japan's LNG imports are forecast to decline to 81 million tonnes. Overall energy demand in Japan remains subdued. At the same time, LNG is expected to face increasing competition from other fuel sources in the power sector, which accounts for two-thirds of Japan's gas consumption.

The recent restart of two nuclear reactors is expected to weigh on LNG imports over the outlook period. The Japanese Government's energy think-tank, the Institute of Energy Economics (IEEJ), expects 10 reactors to be operational by the end of March 2019.

Nevertheless, the timing and scale of nuclear restarts remains a key uncertainty affecting the outlook. In December, the Hiroshima High Court issued an injunction preventing Ikata No. 3 unit, a reactor which had restarted in 2016 and was offline for maintenance, from returning to service in early 2018. The case illustrates how legal challenges and public opposition to nuclear power complicates the outlook for nuclear generation in Japan.

LNG also faces increasing competition in power generation from renewable energy. The IEEJ expects renewable energy generation to increase at an average annual rate of 7.7 per cent between Japanese fiscal years (April to March) 2016–17 and 2018–19.

Prospects for growth in South Korea's imports remain limited

South Korea's LNG imports increased by 15 per cent year-on-year in the first ten months of 2017. The rise was supported by increased gas-fired power generation, with a number of nuclear reactors offline and nuclear-power generation down during the first ten months of the year. South

Korea's LNG imports are estimated to have increased by 11 per cent to 36 million tonnes in 2017.

South Korea's LNG imports are forecast to be slightly lower in 2018 and 2019. Around half of South Korea's gas imports are used in the power sector. South Korea experienced a number of unexpected nuclear outages over 2017, and the return to operation of nuclear reactors over 2018 is expected to weigh on LNG imports. However, several announcements by the recently elected South Korean government should support the use of LNG in power generation, partly offsetting the return of nuclear capacity.

From 2018, South Korea will suspend operations at eight old coal-fired power stations between March and June each year in order to reduce air pollution, permanently closing ten aged coal-fired power stations before mid-2022. If coal-fired capacity is reduced, increased LNG imports may be required.

South Korea will also raise its coal consumption tax by as much as 22 per cent from the start of 2018, increasing the cost-competitiveness of gas.

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

China's LNG imports increased by 62 per cent year-on-year in the first ten months of 2017, supported by surging gas demand, which set a seasonal record in each of the first 10 months of the year. Increased consumption has been attributed to the effect of government policies designed to reduce air pollution by encouraging the use of gas in place of coal. LNG imports are estimated to have totalled 37 million tonnes (50 billion cubic metres) in 2017.

A combination of strong economic growth and energy policy targets are expected to support increased gas consumption over the next few years. The Chinese government is aiming to increase the share of gas in the energy mix from 5.3 per cent in 2015 to 10 per cent by 2020, with the objectives of reducing air pollution and lowering carbon emissions. China's National Development and Reform Commission expects gas consumption to reach 320–360 billion cubic metres in 2020. LNG is expected to play an important role in servicing rising gas demand. China's LNG imports are forecast to rise to 45 million tonnes in 2019 (61 billion cubic metres).

Other emerging Asian economies are expected to make a large contribution to growth in global LNG imports. Growth will be underpinned by low LNG spot and short-term contract prices, and the availability of floating storage and regasification unit (FSRU) technology, which allows small volumes of LNG to be received more cheaply.

India, for example, is aiming to increase the share of gas in the energy mix from about 6 per cent to around 15 per cent, although the timeline for this remains unclear. With no pipeline import infrastructure, a combination of domestic production and LNG imports is expected to be required to meet growing demand.

Europe's LNG imports are expected to increase

European LNG imports are forecast to increase from an estimated 41 million tonnes in 2017 to 72 million tonnes in 2019. While gas consumption is expected to remain relatively flat, falling domestic production and a desire to diversify away from Russian pipeline supply are expected to support LNG imports.

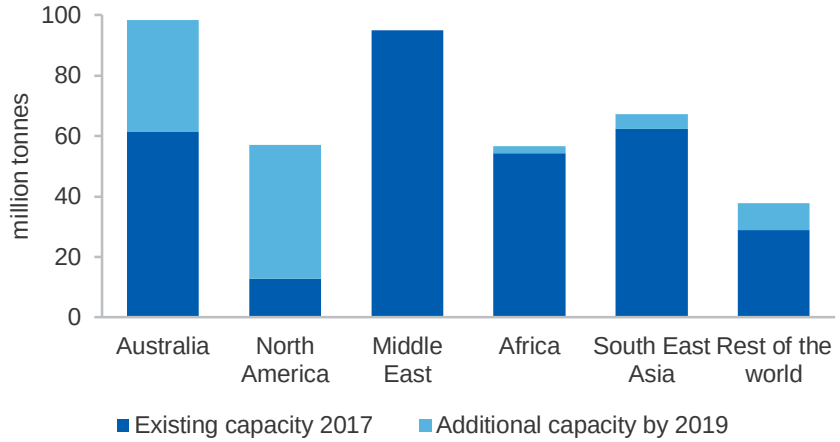
Europe is not a major destination for Australia's LNG exports. However, if LNG demand in Europe does not grow as strongly as projected, Qatari and US LNG may be displaced, potentially bringing increased competition to the Asia-Pacific market.

7.5 World exports

Global supply capacity to rise

The next few years are expected to see a major expansion in global supply capacity. Around half of all new liquefaction capacity will come from the United States.

Figure 7.5: Global LNG supply capacity



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

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

There is currently one US LNG export facility in operation, Sabine Pass in Louisiana. The fourth of five 4.5 million tonne trains at the Sabine Pass project was completed in October, bringing US nameplate capacity to 18 million tonnes.

By the end of 2019, all five LNG projects currently under construction in the United States (combined nameplate capacity 64 million tonnes) are expected to have started production. However, US exports are only forecast to rise to around 37 million tonnes in 2019, with many of these projects scheduled for completion late in the outlook period.

With the US expected to be a major source of new supply, it is possible that the cost of delivering US gas to Asia could cap LNG spot prices in the region. The cost of US LNG will be determined by the price for which US LNG exporters can purchase domestic gas for export, plus the cost of liquefaction and transportation.

If current Henry Hub prices persist, and if tolling fees (fixed charges paid by LNG buyers that cover the capital costs of US LNG plants) are treated as a sunk cost, US LNG could potentially reach Asian markets for as little as US$5.0 per MMbtu ($6.30 a gigajoule). Henry Hub spot prices — the reference price for US domestic gas — remain about US$3.0 per MMbtu mark (around $3.80 a gigajoule). Liquefaction and transportation costs from the US Gulf Coast are thought to be about US$2.0 per MMbtu ($2.50 a gigajoule) at present, although estimates for transport costs vary.

Qatar's exports are forecast to remain largely unchanged

Qatar is the world's largest LNG exporter. 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 around 74 million tonnes.

Qatar's decision in April to lift the moratorium on new gas development at its North Field, and potentially expand its LNG production capacity, is not expected to affect its LNG exports within the two-year outlook period. The long-term outlook for exports from Qatar, the United States and Australia is discussed in Box 7.1.

Box 7.1: Gas, the IEA and the world's largest LNG exporter

In 2011, the IEA asked whether the world was entering 'the golden age of gas'. Six years on, the North American shale gas revolution has been hugely successful, but gas demand growth has slowed considerably. Under the IEA's New Policies Scenario, published in the 2017 World Energy Outlook, gas demand grows at 1.6 per cent a year to 2040. While growth is faster than for the other fossil fuels, it is well down on the average 2.3 per cent a year seen over the past 25 years.

In the IEA's New Policies Scenario, growth in gas consumption is driven by industrial demand and, after 2025, demand from the power sector. The main countries driving gas consumption are in Asia. China accounts for almost a quarter of additional global gas demand over the outlook period — the most of any country. By 2040, gas accounts for 25 per cent of the global energy mix, up from 22 per cent in 2016.

While gas demand growth remains moderate, it drives a major expansion in the relatively small global LNG market. With over 103 million tonnes of LNG production capacity under construction, gas markets remain well supplied for the next few years. By the mid-2020s, however, market over-capacity is expected to be absorbed by import growth. Investment in new LNG capacity is likely to be needed from 2020 onwards.

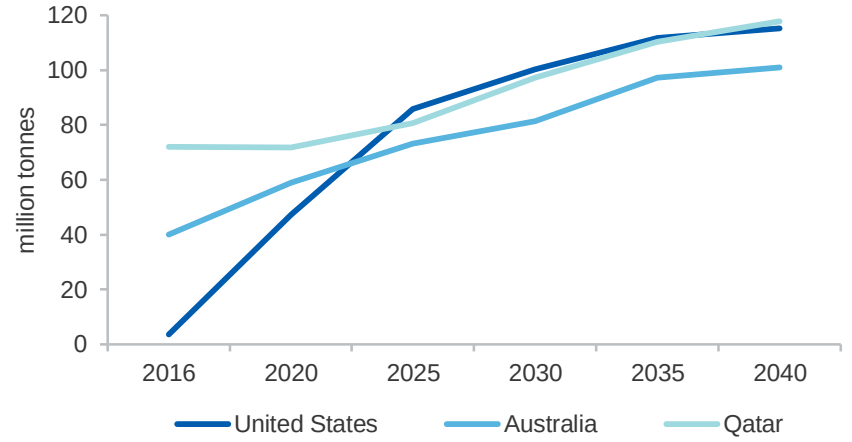
What of the title of world's largest LNG exporter? Australia was the second largest LNG exporter in the world in 2016, exporting 45 million tonnes of LNG. Qatar, the largest exporter, exported 74 million tonnes. Malaysia was the third largest LNG exporting country at 25 million tonnes. The United States exported just 4 million tonnes.

OCE projections are for Australia to overtake Qatar as the world's largest exporter in 2019. However, Australia's hold on the title may only be short-lived. Under the IEA's New Policies Scenario, some new Australian LNG projects come to fruition over the outlook period, but these are smaller incremental projects and there is no second investment wave comparable to the boom of the last 10 years.

In contrast, LNG exports increase rapidly in the United States during the 2020s, underpinned by the relatively low cost of production of domestic gas. This increase sees the United States become the world's largest LNG exporting country in the mid-2020s. LNG shipments from the United States are projected to reach 86 million tonnes in 2025 and 115 million tonnes in 2040.

The United States' time as the world's largest LNG exporter, however, is only expected to be temporary. Qatar's large and low cost gas resources provide the foundation for a continued expansion in its LNG exports over the next two decades. This expansion begins in the early to mid-2020s, with Qatar having recently lifted its self-imposed moratorium on its North Gas field. Qatar draws level with the United States in the mid-2030s before edging past the United States by the end of the decade.

Figure 7.6: Selected country's LNG exports in the IEA's New Policies Scenario



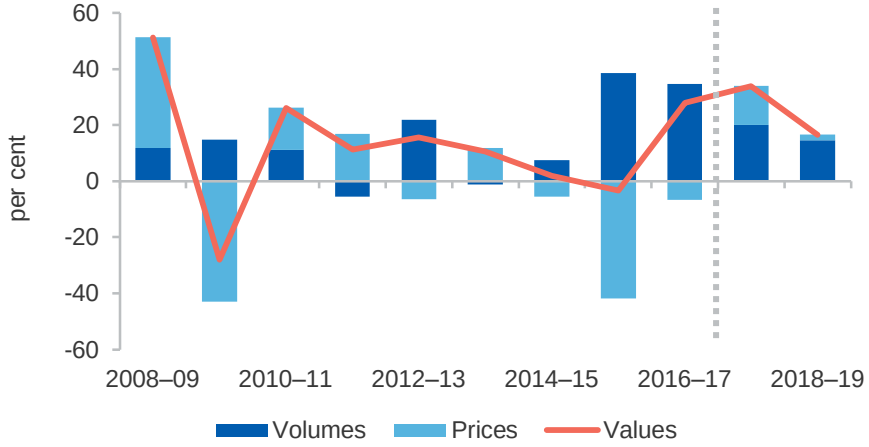
Source: International Energy Agency (2017) World Energy Outlook

7.6 Australia

LNG export earnings to increase, driven by higher export volumes

The value of Australia's LNG exports increased by 41 per cent year-on-year in the September quarter, with both the price and volume of Australia's LNG exports higher than a year earlier. Australia's LNG export earnings are forecast to increase from $22 billion in 2016–17 to $36 billion in 2018–19. Rising export values will be propelled by higher export volumes and, to a lesser extent, higher prices.

Figure 7.7: Annual growth in Australia's LNG export values, contributions from prices and export volumes

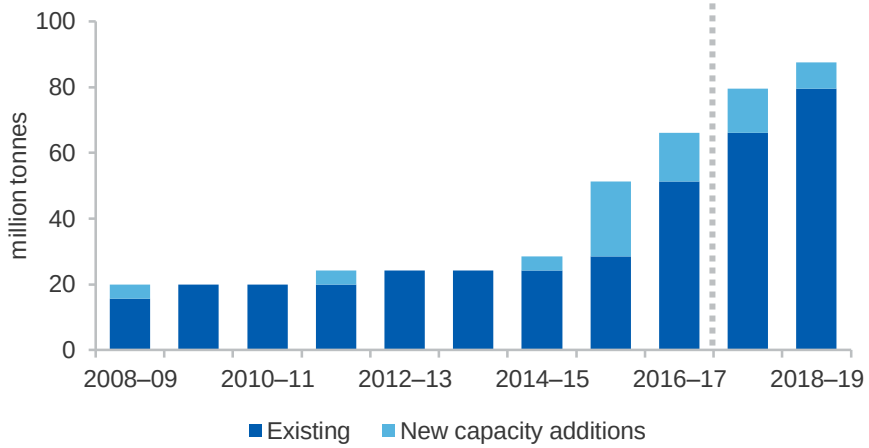


Notes: Log change is used to approximate percentage change. The approximation becomes less accurate the larger the percentage change.

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

Australia's LNG export volumes are forecast to reach 77 million tonnes in 2018–19, up from 52 million tonnes in 2016–17. Higher export volumes will be driven by increased 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.

Figure 7.8: Australia's LNG export capacity



Notes: Nameplate capacity.

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

Chevron's Wheatstone project is likely to be the first of the three projects completed, with train 2 due online in the June quarter 2018. First LNG production at Inpex's Ichthys project is expected in the March quarter 2018, with some reports indicating that train 2 could commence operations as soon as a few months later. Shell's Prelude Floating LNG project is likely to be the last of Australia's recent wave of seven LNG projects to be completed, with Shell indicating Prelude will be completed between May and August 2018.

Japan, South Korea and China are expected to be the major destinations for Australia's LNG exports. While prospects for growth in the imports of Japan and South Korea are limited, Australian producers are expected to capture an increasing share of both country's imports.

The forecast for export values is little changed

There have been a number of revisions since the September 2017 *Resources and Energy Quarterly*. In 2017–18, forecast export values are $0.3 billion lower due to upward revisions to the AUD-USD exchange rate

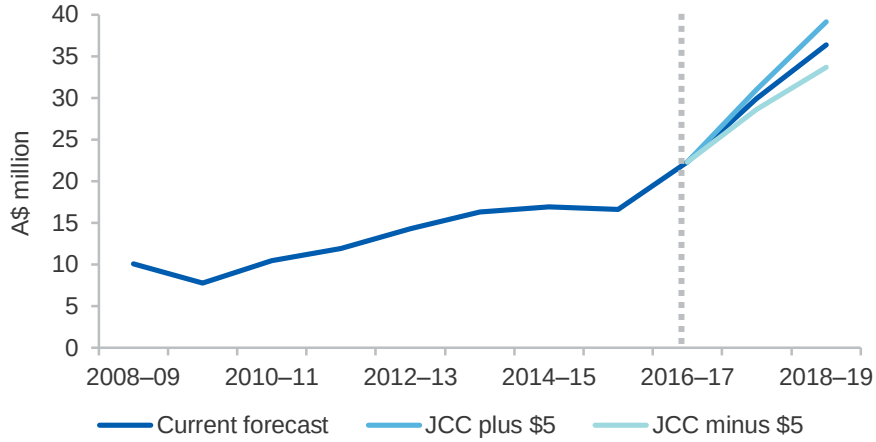
and a lower than expected September quarter 2017 export earnings result. In 2018–19, export values are $1.0 billion higher, with an improved outlook for oil prices and export volumes.

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.

Some uncertainty also surrounds the outlook for export volumes, with competition in global LNG markets is set to intensify. The cost competitiveness of Australian LNG projects and the amount of flexibility in Australian LNG contracts are two important factors. LNG contracts often include clauses which allow buyers to reduce purchases to minimum 'take-or-pay' levels. It is possible buyers may utilise these 'take-or-pay' provisions in their oil-linked contracts if oil prices are higher than spot prices, or if they become over-contracted for LNG.

Figure 7.9: LNG export earnings and the oil price sensitivity



Notes: JCC stands for Japan Customs-cleared Crude.

Source: Argus Media (2017); Nexant World Gas Model (2017); 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$/bbl	41.9	51.9	57.0	56.7	23.9	9.9	-0.5
– real h	US$/bbl	42.7	51.9	55.8	54.3	21.4	7.6	-2.6
Gas production t	Bcm	3 569.5	3 648.3	3 725.2	3 790.3	2.2	2.1	1.7
Gas consumption t	Bcm	3 534.5	3 646.1	3 699.8	3 769.9	3.2	1.5	1.9
LNG trade d	Mt	250.2	277.5	304.8	325.6	10.9	9.8	6.8
Australia	**Unit**	**2015–16**	**2016–17**	**2017–18 f**	**2018–19 f**	**2016–17**	**2017–18 f**	**2018–19 f**
Production b	Bcm	88.2	105.3	124.2	143.5	19.3	18.0	15.6
– Eastern market	Bcm	43.4	54.3	57.6	58.5	25.1	6.0	1.6
– Western market	Bcm	43.8	49.6	64.6	74.2	13.2	30.2	14.9
– Northern market c	Bcm	0.9	1.3	2.0	10.8	44.3	49.8	441.7
LNG export volume d	Mt	36.9	52.1	63.0	76.5	41.4	20.9	21.4
– nominal value	A$m	16,576	22,299	29,911	36,392	34.5	34.1	21.7
– real value e	A$m	17,206	22,758	29,911	35,543	32.3	31.4	18.8
LNG export unit value g								
– nominal value	A$/GJ	8.5	8.1	9.0	9.0	-4.9	10.9	0.2
– real value e	A$/GJ	8.8	8.3	9.0	8.8	-6.5	8.7	-2.2
– nominal value	US$/MMBtu	6.6	6.5	7.3	7.3	-1.5	13.6	-0.1
– real value e	US$/MMBtu	6.8	6.6	7.3	7.2	-3.1	11.3	-2.5

Notes: 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) and 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 2017–18 Australian dollars; **f** Forecast; **g** 1 MMBtu is equivalent to 1.055 GJ; **h** In 2017 US dollars;**s** Estimate; **t** 2016 is an estimate.

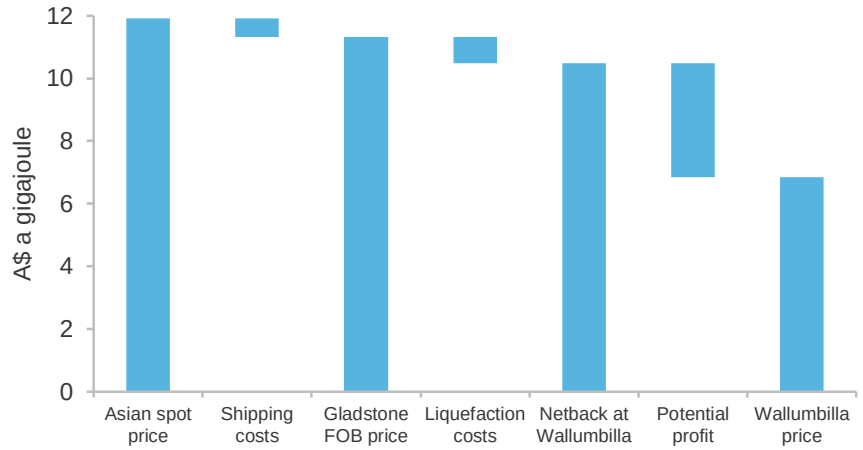
Source: ABS (2017) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Department of Industry, Innovation and Science (2017); Company reports; Nexant World Gas Model (2017)

7.7 Appendix: LNG netbacks and domestic spot prices

LNG spot prices in North Asia have increased over the past few months, reaching their highest level in almost three years in November. The spike appears to have been driven by unexpected outages at several LNG plants and strong pre-winter buying from major customers, most notably China. Yet domestic wholesale spot prices on Australia's east coast have fallen over the same period, challenging the conventional wisdom that domestic prices should move with LNG netbacks.

An LNG netback is an LNG price minus the costs involved in getting the gas to the destination in question, such as transportation and liquefaction. For example, the LNG spot price netback from Japan to Wallumbilla (a gas hub in Queensland) refers to the price of spot LNG delivered to Japan minus the costs of getting gas from Wallumbilla to Japan.

Figure 7.10: Netback at Wallumbilla from North East Asian LNG spot price, November 2017



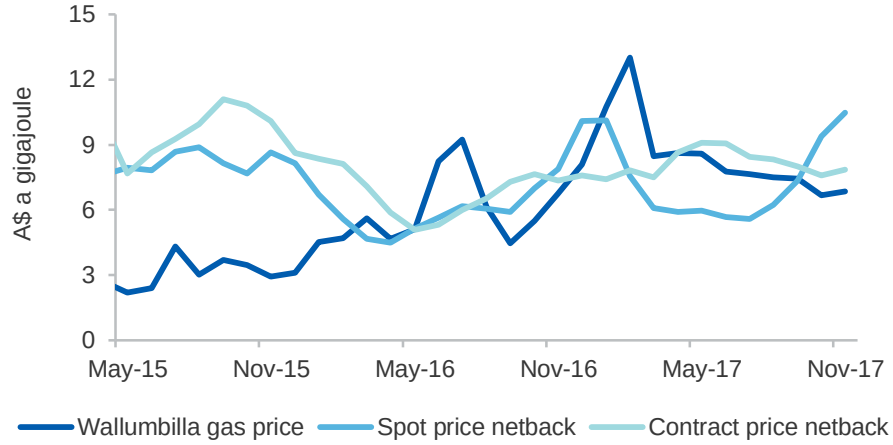
Notes: the marginal cost of transporting gas via pipeline from Wallumbilla to Gladstone is assumed to be zero, consistent with the September 2017 ACCC Gas Inquiry.

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

If LNG netbacks are higher than domestic prices, then LNG exporters should be willing to purchase domestic gas to on-sell to international customers, putting upward pressure on domestic prices. If netbacks are lower than domestic prices, then LNG operators have incentives to direct uncontracted gas to the domestic market, putting downward pressure on domestic prices. LNG netbacks and domestic gas prices therefore converge, or so the argument goes.

While most Australian gas is traded on confidential bilateral contracts, the prices that can be observed — those on domestic spot markets — have not followed movements in Asian LNG spot price netbacks in recent months. Meanwhile, netbacks from oil-linked LNG contract prices remain above domestic spot prices.

Figure 7.11: LNG spot and oil-linked contract price netbacks at Wallumbilla, monthly



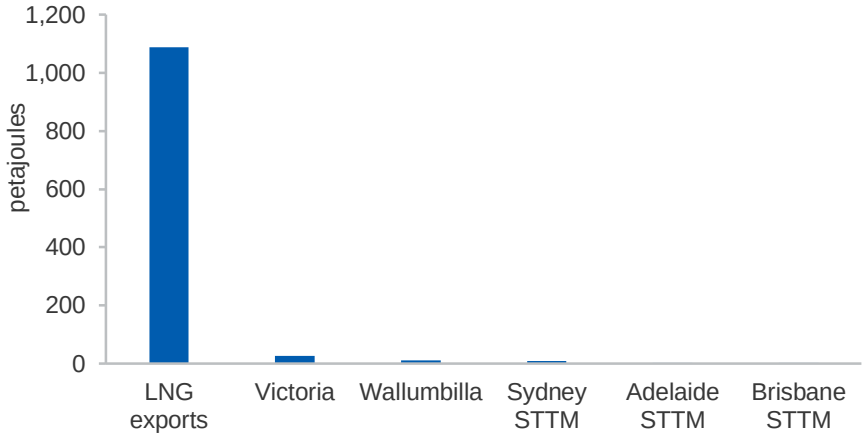
Notes: netbacks are calculated using historical shipping price data and assumptions on liquefaction costs. The spot price netback uses the Argus North East Asian spot price. The FOB price of LNG on Gladstone oil-linked contracts is estimated at 14 per cent of the three-month lagged Japan Customs-cleared Crude (JCC) oil price.

Source: AEMO (2017); Bloomberg (2017); Argus (2017); Department of Industry, Innovation and Science (2017).

There are a number of possible reasons for the divergence between LNG netbacks and domestic spot prices. The responsiveness of domestic prices to LNG netbacks is premised on the idea that LNG exporters are highly responsive to opportunities to purchase gas on domestic spot

markets. One reason LNG exporters may not be able to capitalise on lower domestic prices is that domestic spot markets tend to be thin — opportunities to purchase sufficient amounts of gas for export may not be available. For example, gas trades at the Wallumbilla averaged just 0.9 petajoules a month over the 12 months to November 2017. In contrast, a cargo of LNG from Gladstone contains around 3.5 PJs of gas. Around 25 cargoes are shipped from Gladstone per month.

Figure 7.12: East coast LNG exports and trading at east coast gas hubs, 12 months to November 2017



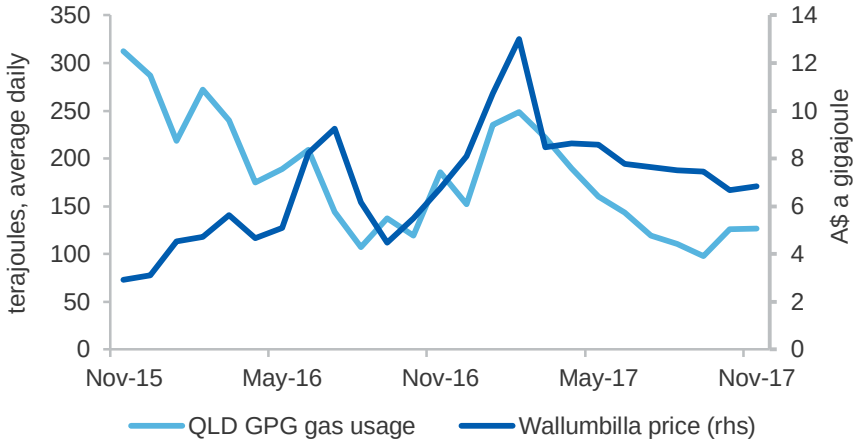
Notes: DWGM stands for Declared Wholesale Gas Market. Wallumbilla is a gas supply hub. STTM stands for Short Term Trading Market. 1 million tonnes of LNG = 54.4 petajoules. LNG exports do not include gas used by LNG exporters in the process of producing LNG.

Source: Australian Energy Market Operator (2017); Gladstone Ports Corporation (2017)

Other issues also complicate the relationship between netbacks and domestic spot prices. If LNG exporters are to take advantage of low domestic spot prices and buy gas, they must be able to vary their exports in line with those spot market purchases. This may take some time, since exporters need to secure customers for spot cargoes, which may involve applying for and winning tenders put out by buyers. Exporters must also manage operational requirements (such as plant maintenance), which may discourage opportunistic spot market purchases, even at times when international prices are relatively high. Finally, exporters may not be willing to pay all the way up to LNG netback prices for gas on domestic spot markets, as potential profits from reselling the gas to international customers at this point are reduced to zero.

There are also other influences on domestic gas prices. For example, when electricity prices are high enough to cover gas input costs, gas power generation operators may purchase gas from domestic spot markets, pushing up prices.

Figure 7.13: Wallumbilla gas prices and gas used for gas powered generation (GPG) in Queensland, monthly

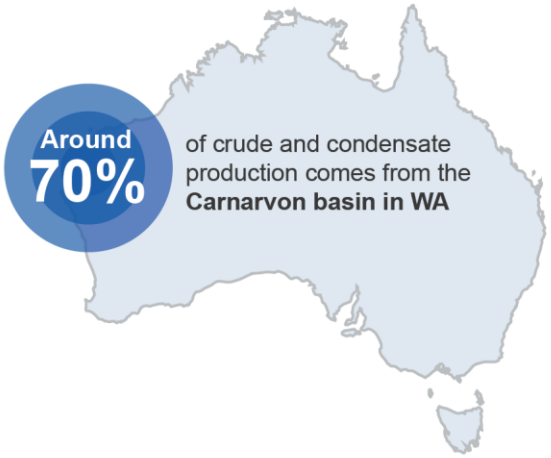


Source: Australian Energy Market Operator (2017); Australian Energy Regulator (2017)

LNG netbacks do exert an influence on domestic gas prices. The ACCC, for example, has found that expectations of LNG netback prices play an important role in informing contract price negotiations. However, in the case of domestic spot markets, the data to date suggests that spot prices will not necessarily be equal to LNG netbacks, nor necessarily follow their short term movements. This could be due a range of factors, including a lack of liquidity in domestic spot markets, rigidities in organising sales of spot LNG, and other influences on domestic spot prices.

Oil

Resources and Energy Quarterly December 2017



Australia's production of crude and condensate peaked in **2000**, at

41,300 ML

Around 17%

of refinery feedstock is domestically produced. On average 83% is imported.

Australia's refinery production

45% automative gasoline

35% diesel

13% aviation turbine fuel

3% LPG

2% fuel oil

2% other

Top export destinations for Australia's crude oil, 2016–17 (million litres)

1 **Singapore** 2380.7

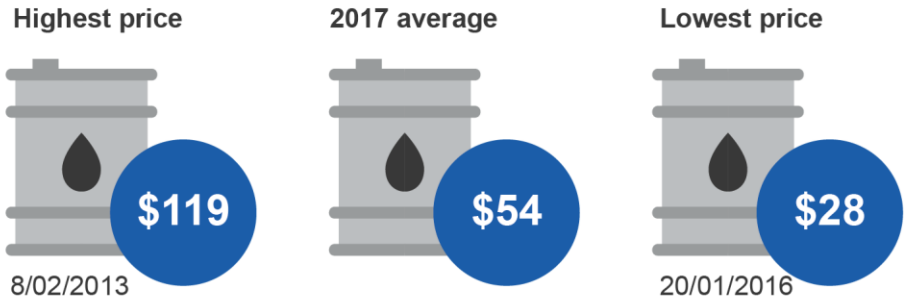
2 **Indonesia** 2269.0

3 **China** 1600.3

4 **Thailand** 1354.5

5 **Malaysia** 1048.4

Historic price snap shot: Brent crude oil in the last five years (US$ per barrel)



8.1 Summary

- Australia's crude oil and condensate exports are forecast to increase from $5.5 billion in 2016–17 to $6.0 billion in 2017–18, driven by higher oil prices. Further increases are expected in 2018–19, as higher condensate production supports forecast export earnings of $7.0 billion.
- Over the outlook period, Australia's production will be characterised by decreasing crude oil production, which will be offset by higher condensate production, related to several new LNG projects.
- World oil prices are forecast to steadily increase over the outlook period, as constrained world production continues under the OPEC Production Agreement and world consumption grows, particularly in emerging Asia.

8.2 Prices

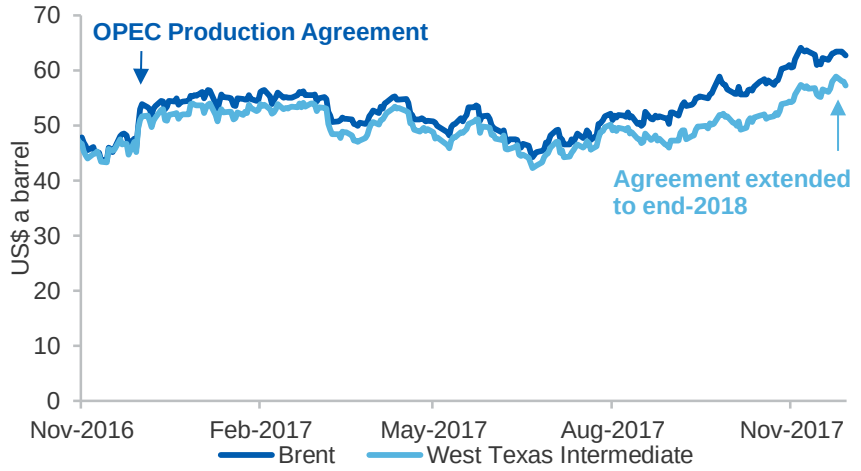
Oil prices reach two year highs

Brent crude oil averaged US$60 a barrel during the December quarter, while WTI averaged US$54 a barrel. Oil prices reached the highest point in two years, and reflecting strong consumption growth, supply uncertainty stemming from conflict in the Middle East and the continuation of the OPEC Production Agreement. The extension of the OPEC production agreement to the end of 2018 has strengthened the outlook for oil prices, as agreement compliance has been moderately good and the announcement improved market certainty about production in 2018.

Positive outlook for oil prices

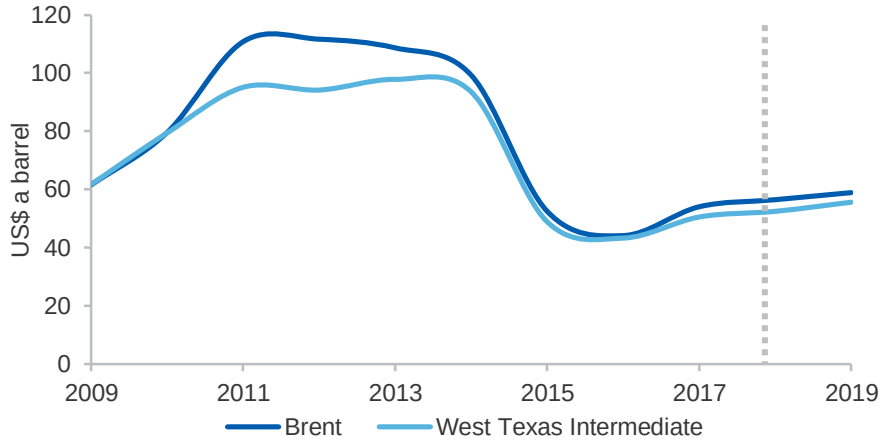
Current high spot prices are expected to fall back at the start of 2018, as the factors supporting recent price strength are not expected to last. Oil prices are forecast to increase modestly, supported by strong OPEC compliance and expectations about consumption growth. Crude oil prices are forecast to increase by 4.5 per cent in 2018, with Brent crude averaging US$56 a barrel and WTI averaging US$52 a barrel. Oil prices are forecast to increase further in 2019, averaging US$59 a barrel for Brent and US$55 a barrel for WTI.

Figure 8.1: Oil prices over the last year



Source: Bloomberg (2017); Brent and West Texas Intermediate spot prices

Figure 8.2: Annual oil prices



Source: Bloomberg (2017); Brent and West Texas Intermediate spot prices; Department of Industry, Innovation and Science (2017)

8.3 World oil consumption

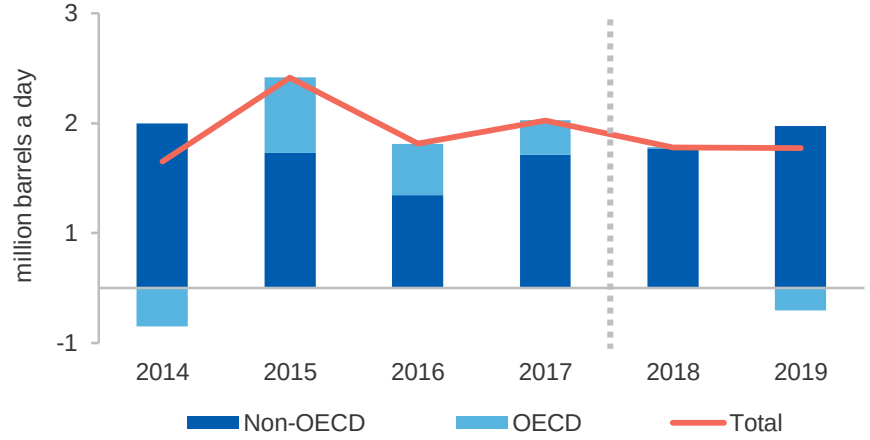
In 2017 oil consumption is estimated to have expanded by 1.6 per cent, to 97.7 million barrels a day, supported by growing non-OECD consumption.

Consumption to reach 100 million barrels a day

Over the outlook period, consumption is forecast to increase at an annual rate of 1.3 per cent in 2018 and 2019, and is set to exceed 100 million barrels a day in 2019. OECD consumption is expected to stay at current levels, at around 47 million barrels a day. Non-OCED consumption is forecast to increase at an average annual rate of 2.7 per cent, reaching 53.2 million barrels a day in 2019.

Future population growth and low oil prices are expected to support consumption growth, however the rate of growth is expected to slow over the outlook period. China's consumption is forecast to increase by 1.9 per cent a year, to reach 12.9 million barrels a day in 2019. Long-term projections of consumption will be affected by government policies, as discussed in Box 8.1.

Figure 8.3: Forecast consumption growth



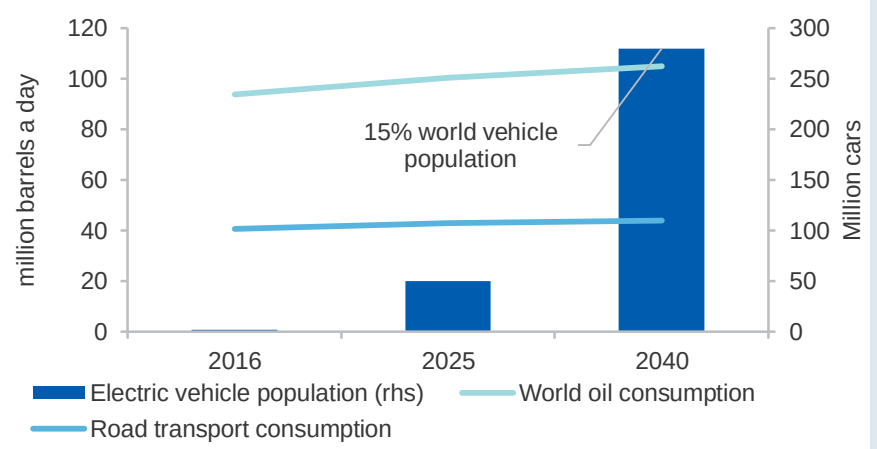
Source: International Energy Agency Monthly Oil Data Service (2017); Department of Industry, Innovation and Science (2017)

Box 8.1: Long-term oil consumption in the IEA's *World Energy Outlook*

The long-term outlook for oil markets is highly dependent on uptake of new technologies and energy sources. Under the International Energy Agency's (IEA) main scenario, the 'New Policies Scenario' in the 2017 World Energy Outlook, oil consumption grows moderately to 2025, before transitioning to lower growth from 2025 to 2040. Oil consumption is projected to grow 0.6 per cent a year to 2040. Lower consumption in the US and Europe is expected to be offset by expanding markets in the Asia Pacific and the Middle East.

Road transport, the largest component of oil consumption, is projected to grow by 0.3 per cent a year to 2040, maintaining a consistent share of total oil consumption. Vehicle efficiency policies and expanding electric vehicle fleets will have a dampening effect on oil consumption growth, however, in a low oil price environment, these transitions will be very dependent on government policies. The IEA projects the 2040 vehicle fleet will be twice as efficient as it is today, though aviation, shipping and road freight remain heavily dependent on oil.

Figure 8.4: Oil consumption growth in IEA New Policies Scenario



Source: International Energy Agency (2017), World Energy Outlook 2017, OECD/IEA, Paris

8.4 World oil production

Global production and consumption rebalancing in 2018

In 2017 world production is estimated to have been 97.3 million barrels a day, a marginal increase on 2016 levels. Over the outlook period production total production is forecast to increase by 1.8 per cent, to reach 99.1 million barrels a day in 2018. This is lower than previously forecast, as the OPEC Production Agreement has recently been extended. Lower OPEC production is expected to be offset with higher non-OPEC production, primarily from the US. Canada and Brazil are also expected to increase production, lifting total non-OPEC production to 59.5 million barrels a day in 2018, 2.5 per higher than 2017.

Towards the end of the outlook period, as OPEC production is expected to return to the market, world production is forecast to reach 100.7 million barrels a day in 2019.

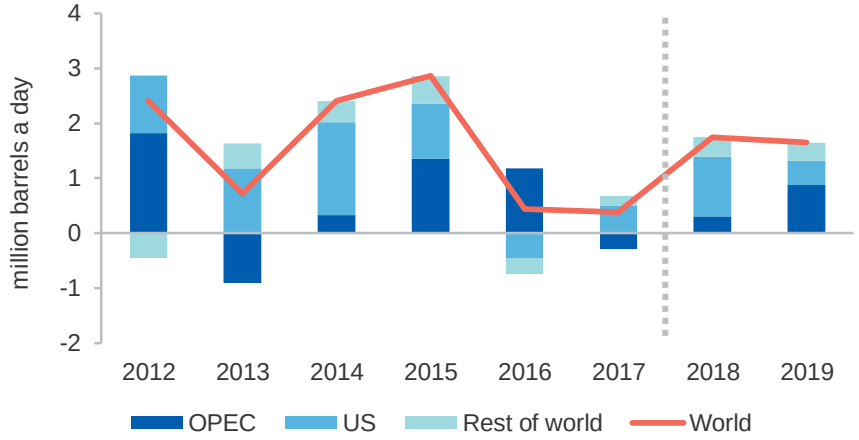
The rate at which US production increases and compliance under the OPEC Production Agreement are uncertainties that heavily affect the outlook and are downward risks to the oil price forecast.

OPEC holds strong on production agreement and extends

The 2017 OPEC Production Agreement, held by 22 OPEC and non-OPEC producers including Russia, commenced in January 2017 and aimed to reduce annual production by 1.8 million barrels a day. The production controls were introduced to reduce excess oil supplies in world markets, to reduce stock levels and support higher prices. With modest improvements in these areas, OPEC has recently extended the agreement until the end of 2018.

In 2017, the agreement was largely upheld, with an 87 per cent compliance rate in the year to October. Saudi Arabia's estimated production in the year to October was 3.6 per cent lower than the same period in 2016. As a result, OPEC's combined production for 2017 is estimated to be around 0.7 per cent lower than 2016 levels, at 39.3 million barrels a day.

Figure 8.5: Change in world production



Source: International Energy Agency Monthly Oil Data Service (2017); Department of Industry, Innovation and Science (2017)

Record US production and exports

US oil production is estimated to have increased by 4.6 per cent in 2017, to 13.0 million barrels a day. Lower production related to Hurricane Harvey and Hurricane Nate, was outweighed by higher shale oil production. Shale oil production has reached record high levels, averaging an estimated 5.6 million barrels a day in December, as industry activity returns after a low oil price period in 2016.

US production is expected to reach record levels over the outlook period, supported by growth in unconventional oil and liquids production. As US output increases, world production dynamics are expected to shift, as discussed in Box 8.2. In 2018, US crude oil production is forecast to rise 9.6 per cent, to 14.1 million barrels a day. The most significant output increases are expected from the Permian Basin. Across the US, Drilled but Uncomplete Well numbers reached 7,342 in October, the highest on record. Stronger oil prices are likely to support continued drilling, solidifying expectations about US production growth.

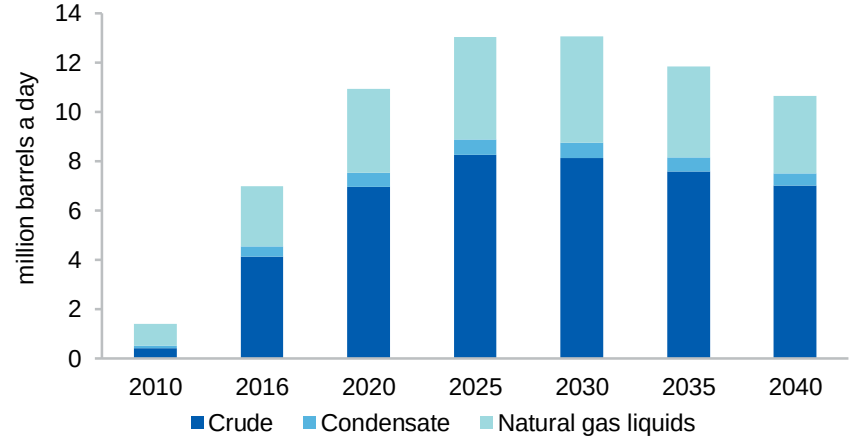
Box 8.2: US production projections in the IEA's World Energy Outlook

Significant changes in world production dynamics are highlighted in the IEA's 2017 World Energy Outlook, with growth in US production accounting for 80 per cent of world production growth to 2025. The size of US tight oil reserves have been revised up, from 80 billion barrels in WEO 2016 to 105 billion barrels in WEO 2017. Although there is uncertainty around the exact resource size and related production costs, the outlook for higher non-conventional US production is significant.

The IEA projects US tight liquids production will almost double between 2016 and 2025, reaching 13.05 million barrels a day in 2025. This significant production growth is expected to facilitate the US becoming a net oil exporter around 2028.

Towards the end of the outlook period, US production is expected to plateau as OPEC production returns to dominance. Through steady expansion in production to 2040, OPEC's share of world production is projected to increase from the 40 per cent to around 45 per cent in 2040.

Figure 8.6: US tight liquids production in the IEA's New Policies Scenario



Source: International Energy Agency (2017), World Energy Outlook 2017, OECD/IEA, Paris

8.5 Australia's production and trade

Higher export earnings, supported by prices and condensate production

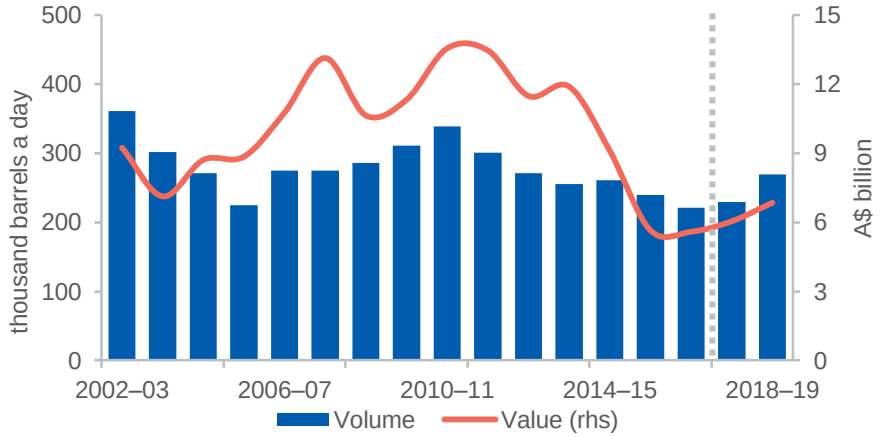
Australia's petroleum export earnings rose to $1.5 billion in the September quarter, an annual increase of 13 per cent. Higher export volumes and higher realised prices supported this growth.

Export earnings are forecast to increase from $5.5 billion in 2016–17 to $7.0 billion in 2018–19, as significantly higher condensate production leads to increases in export volumes. Modest increases in oil prices are also expected to support earnings growth.

Revisions to export forecasts

Since the September 2017 *Resources and Energy Quarterly,* forecast export earnings have been revised down slightly, as the impact of higher prices is outweighed by the stronger Australian dollar and delayed commencement of new condensate production. Forecast export earnings have been revised down by $175 million in 2017–18 and by $287 million in 2018–19.

Figure 8.7: Australia's export volumes and values



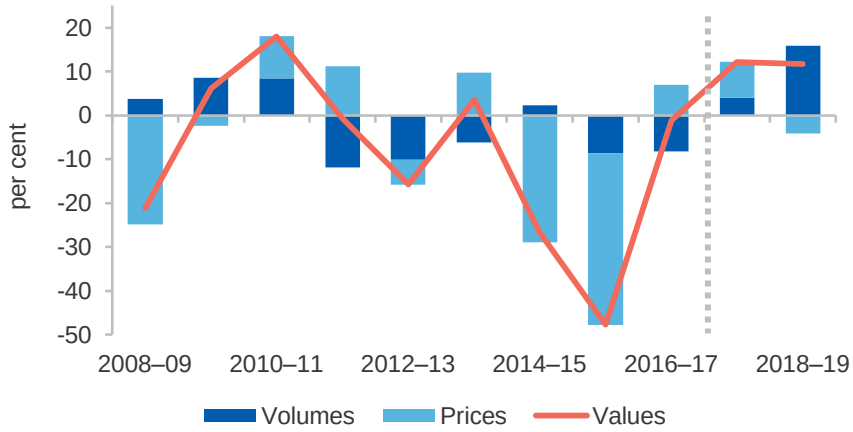
Source: Department of Environment and Energy, Australian Petroleum Statistics (2017); EnergyQuest (2017); Department of Industry, Innovation and Science (2017)

Strong increase in export volumes driven by condensate production

Export volumes increased to 243,000 barrels a day in the September quarter, 6.4 per cent higher than in the same period last year. Export volumes are forecast to increase from 221,000 barrels a day in 2016–17 to 269,000 barrels a day in 2018–19, as lower crude oil production is outweighed by significant increases in condensate production related to the new LNG projects.

Over the outlook period, additional condensate output is expected from the Wheatstone, Icthys and Prelude LNG projects, which have nameplate capacities of 3, 100 and 36 thousand barrels a day, respectively. Condensate and LPG production from these projects will be directed towards export markets. The Wheatstone project commenced operations in October, and Icthys is due to start exporting in the March quarter of 2018. Prelude is expected to commence operations in the September quarter of 2018.

Figure 8.8: Annual growth in crude oil and condensate export values, contributions from prices and export volumes



Notes: Log change is used to approximate percentage change.

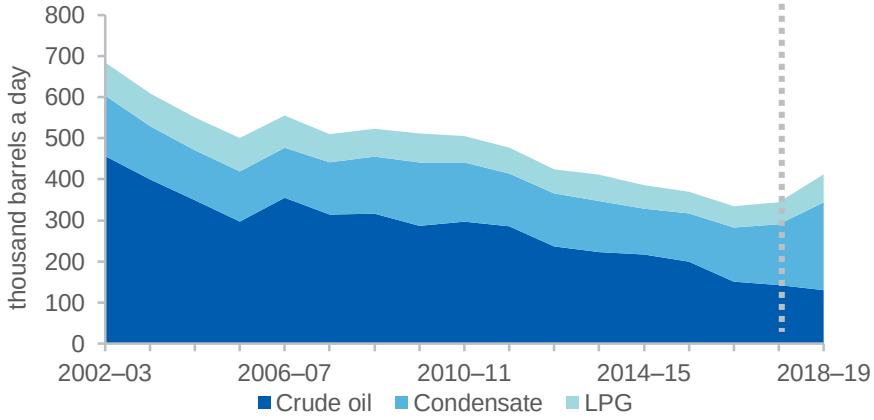
Source: ABS (2017) International Trade, Australia, 5465.0; Department of Industry, Innovation and Science (2017)

Australia's condensate production overtakes crude oil production

Australia's production of crude and condensate averaged 298,000 barrels a day in the September quarter. Significantly lower production in the Bonaparte, Gippsland and Cooper basins contributed to a 7.4 per cent annual decrease in production. Condensate production, increasing by 3.9 per cent over the year, exceeded crude oil production for the first time. Higher output from Gorgon LNG supported condensate production to reach 151,000 barrels a day in the September quarter.

Over the outlook period, Australia's production of crude oil and condensate is forecast to average 291,000 barrels a day in 2017–18, before increasing to 344,000 barrels a day in 2018–19. In addition to new condensate production, the crude oil development project in the pipeline, Greater Enfield, is expected to add 40,000 barrels a day oil production capacity in mid-2019. At the end of the outlook period, condensate production is forecast to account for around 52 per cent of Australia's total petroleum production, up from 39 per cent in 2016–17.

Figure 8.9: Australia's petroleum production



Source: Department of Environment and Energy, Australian Petroleum Statistics (2017); EnergyQuest (2017); Department of Industry, Innovation and Science (2017)

Petroleum exploration expenditure continues to decline

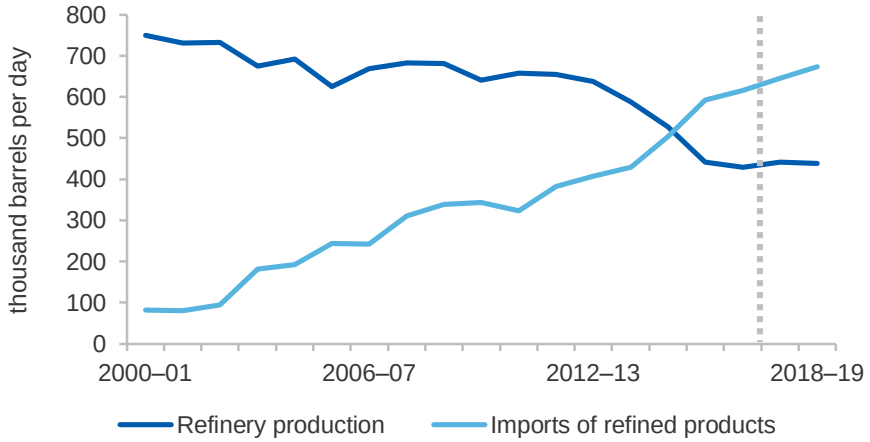
Australia's petroleum exploration expenditure was $285 million in the September quarter, a 20 per cent decrease over the year. Low oil prices have caused a decline in exploration activity, as has the high cost nature of Australia's reserves.

Australia's refinery activity

Australia's rate of refinery production was 451,000 barrels a day in the September quarter, unchanged from the same period in 2016. Refined product imports were 10 per cent higher than the September 2016 quarter, at 9,240 million litres, driven by higher diesel imports.

Over the forecast period, refinery production is expected to increase slightly, reflecting higher production rates from refinery facilities. Refinery production is forecast to average 439,000 barrels a day in 2018–19, increasing at an annual rate of 2.3 per cent over the outlook period.

Figure 8.10: Australia's refined product trade balance



Source: Department of Environment and Energy (2017) Australian Petroleum Statistics; Department of Industry, Innovation and Science (2017)

Table 8.1: Oil outlook

						Annual percentage change		
World	**Unit**	**2016**	**2017 f**	**2018 f**	**2019 f**	**2017 f**	**2018 f**	**2019 f**
Production a	mb/d	97.0	97.3	99.1	100.7	0.4	1.8	1.7
Consumption a	mb/d	96.1	97.7	98.9	100.2	1.6	1.3	1.3
WTI crude oil price								
– nominal	US$/bbl	43.2	50.5	52.4	55.0	16.8	3.8	4.8
– real b	US$/bbl	44.2	50.5	51.4	52.7	14.4	1.7	2.5
Brent crude oil price								
– nominal	US/$bbl	44.1	54.0	56.4	58.9	22.5	4.5	4.3
– real b	US$/bbl	45.0	54.0	55.3	56.4	19.9	2.3	2.1
Australia	**Unit**	**2015–16**	**2016–17**	**2017–18 f**	**2018–19 f**	**2016–17**	**2017–18 f**	**2018–19 f**
Crude oil and condensate								
Production a	kb/d	317	283	291	344	-10.8	2.8	18.3
Export volume a	kb/d	239	221	230	269	-7.8	4.1	17.2
– nominal value	A$m	5,444	5,476	6,045	7,008	0.6	10.4	15.9
– real value g	A$m	5,651	5,588	6,045	6,853	-1.1	8.2	13.4
Imports a	kb/d	342	351	378	363	2.5	8.1	-4.2
LPG								
Production ac	kb/d	53	52	54	68	-1.6	3.2	27.5
Petroleum products								
Refinery production a	kb/d	442	429	442	439	-3.0	3.0	-0.6
Exports ad	kb/d	10	18	13	9	73.7	-30.0	-28.6
Imports a	kb/d	593	616	645	674	3.9	4.6	4.5
Consumption ae	kb/d	950	1,004	1,039	1,030	5.7	3.5	-0.8

Notes: **a** Number of days in a year is assumed to be exactly 365; **b** In 2017 calendar year dollars; **c** Primary products sold as LPG; **d** Excludes LPG; **e** Domestic sales of marketable products; **f** Forecast; **g** In 2016–17 financial year Australian dollars; **s** Estimate; **z** Projection. A barrel of oil equals 158.987 litres

Source: ABS (2017) International Trade Statistics Service, cat. no.5464.0; Energy Information Administration (2017); Department of Industry, Innovation and Science (2017)

Uranium

Resources and Energy Quarterly December 2017

Australia holds **31%** of the world's proven uranium reserves

Australia is the **3rd** largest producer of uranium in the world

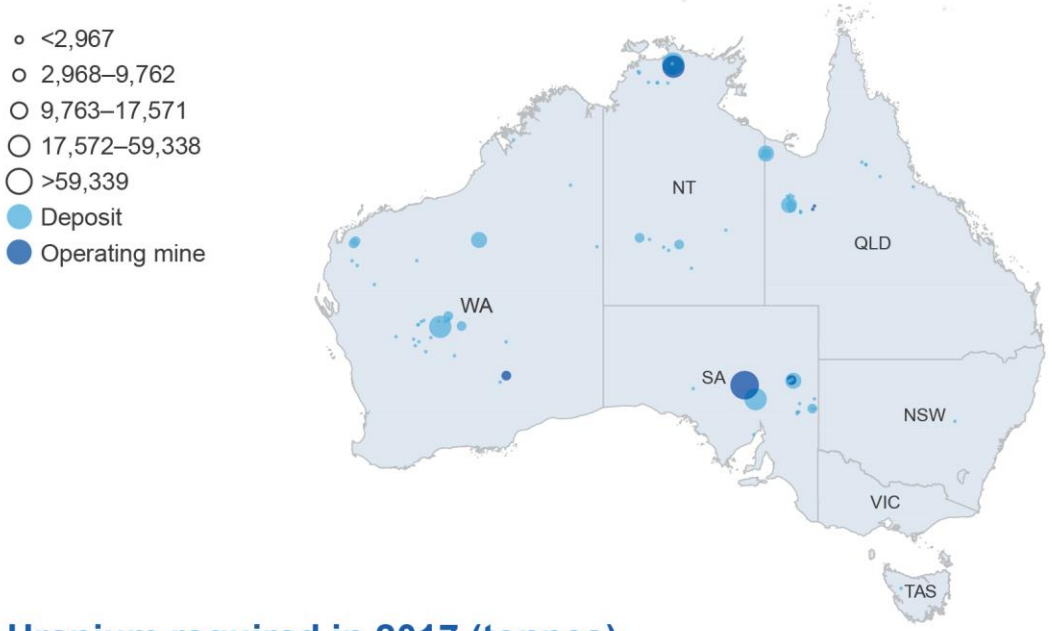
Australia produces and exports more than **7,000 tonnes** of uranium every year

Uranium makes up **11%** of global electricity generation

There are **447** nuclear power reactors across 31 countries, with 60 more being built

There are **245** civil research reactors operating across 55 countries

Major Australian uranium deposits (tonnes)



Uranium required in 2017 (tonnes)

USA	France	Russia	China	South Korea	Japan
17,847	**9,216**	**7,767**	**7,757**	**4,816**	**2,517**

9.1 Summary

- Uranium spot prices remained low in 2017, at just under $US22 a pound, but are expected to recover to around $US27 a pound in 2018 and $US29 a pound in 2019, as market conditions tighten slightly.
- Upgrades at the Olympic Dam facility are expected to impose a temporary disruption on mine output, which will reduce Australian uranium production to 6,990 tonnes in 2017–18.
- Rising demand in Asia and an increase in output at Olympic Dam should support a rebound to 7,100 tonnes in 2018–19.
- Australia's uranium export earnings are expected to increase from just under $600 million in 2016–17 to around $635 million in 2017–18 and 2018–19, with an easing in export contract prices offsetting the impact of higher spot prices.

9.2 Prices

Prices are expected to begin rising from their current historical low

Spot prices appear to have bottomed out, remaining largely unchanged over several successive quarters. Prices averaged $US20.79 a pound in the June quarter, $US20.22 in the September quarter and around $US21.00 in the December quarter. This suggests the long price fall of recent years has finally come to a halt, though at levels well below those needed to support profitable production.

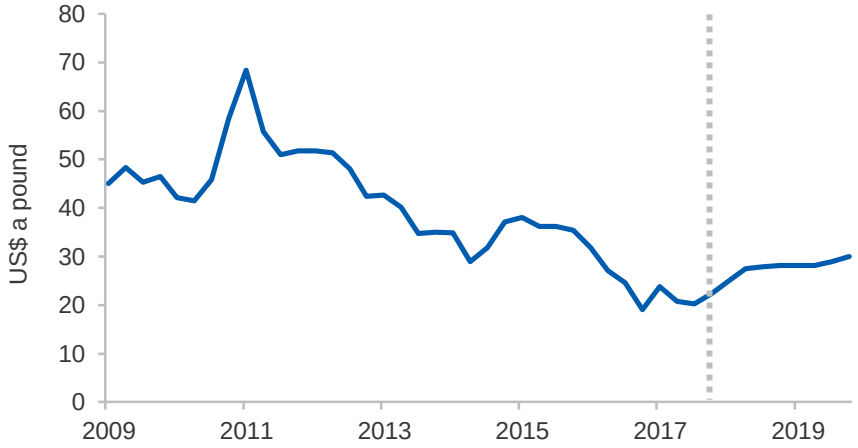
Producers have remained cushioned to some extent by contract prices, but there is downward pressure evident here as well. A number of legacy contracts are expiring, with many more set to do so in coming years. This will likely force some high-cost producers out, curtailing supply at the margins. This will, in turn, place upward pressure on spot prices and gradually close the gap between contract and spot prices.

Prices lifted briefly following an announced production cutback in Kazakhstan, but the rise was not sustained. A similar outcome is expected following a second cut-back in Kazakhstan and an announcement by Cameco of a production cut at its huge MacArthur River mine in Canada.

Substantial secondary markets and inventories will likely dull the effect of these curtailments. However, price pressure is also expected to increase on the demand side. A wave of new reactors is expected to come online in China over the next 12 months. This will likely lead to a spike in demand in the second half of 2018, and a modest reduction in inventories over the outlook period.

As a result, uranium spot prices are forecast to lift from the present low to average $US27.15 a pound in 2018 and $US28.85 a pound in 2019.

Figure 9.1: Outlook, quarterly uranium prices



Source: Cameco Corporation (2017) Uranium Spot Price; Ux Consulting (2017) Uranium Market Outlook

9.3 Consumption

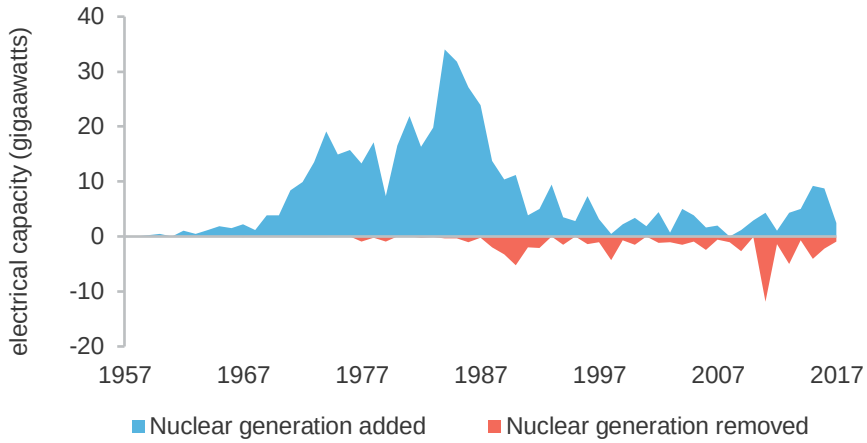
Growth in nuclear energy is concentrated in China, India and Russia

Global uranium consumption is forecast to rise from 82,000 tonnes in 2017 to 86,400 tonnes in 2018 and 89,600 tonnes in 2019. Growth will be largely driven by reactor construction in China, where 16 new reactors are scheduled to commence operation over the end of 2019. These include the Taishan 1 and 2 reactors, which are expected to be two of the largest ever built. New reactors are also expected to be completed in Russia, South Korea, Finland and the United Arab Emirates. Partly offsetting this, reactor closures are expected in Germany, Switzerland, Sweden and France.A wave of new Chinese reactors may create a "spike" in uranium demand in 2018, since new reactors require a full fuel load on commencement (where existing reactors replace only part of their fuel loads each year).

Reactor construction in China continues a long-term trend in nuclear power away from the EU and US and towards Asia. The bulk of currently operating reactors were constructed in the US, UK, Japan, Germany and France in the 1970s and 1980s. Reactor construction in most Western countries subsequently ground to a halt, although there remain long-term plans to expand the reactor fleet in the UK and Canada. The aging of the world's reactor fleet (with a global average reactor age of 29 years) makes it unlikely that nuclear energy will grow substantially as a share of global energy generation over time. Long term prospects for nuclear generation remain highly influenced by the pace of reactor construction in Asia.

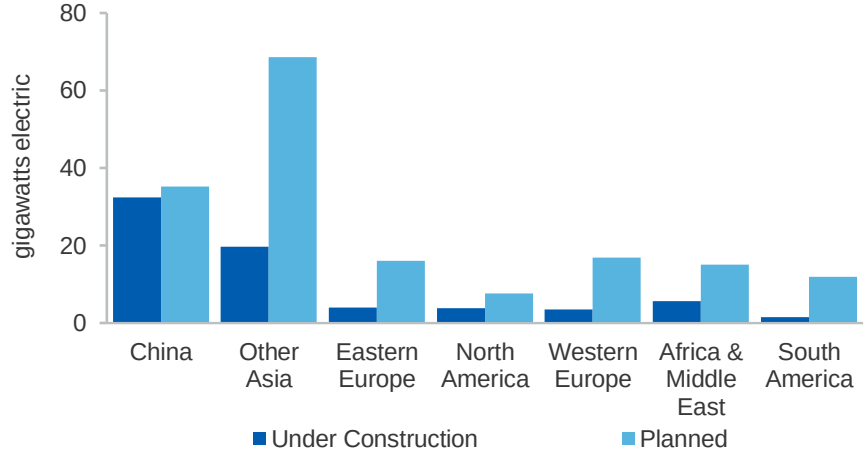
Importantly however, the December quarter showed some improvement in the outlook for nuclear generation across the OECD. In October, the Japanese Government reaffirmed its commitment to reconnecting its reactor fleet. The US Government agreed to $3.7 billion in loan guarantees to progress the stalled Vogtle project, which now appears likely to proceed. The US Government also instructed the Federal Energy Regulatory Commission to adopt new regulations ensuring that nuclear (and coal) plants which support "grid reliability" can recover "fully allocated costs" in order to protect energy security.

Figure 9.2: Annual change to world nuclear power generation



Source: World Nuclear Association (2017)

Figure 9.3: New nuclear capacity



Source: International Energy Agency (2017); World Nuclear Association (2017); DIIS estimates

In South Korea, a citizens' jury rejected previously announced plans to cancel construction of units 5 and 6 of the Shin Kori plant, and the Government has committed to their completion. Ontario has released a plan to refurbish ten reactors and extend the life of six others, ensuring significant nuclear power generation in Canada until 2064. The French government has announced that earlier plans for rapid phase-down of nuclear power will be replaced with a more "realistic" target.

However, although the environment for existing nuclear energy production has stabilised, there remains no significant pipeline of nuclear power plant construction across the OECD, and isolated projects underway face a high risk of cost blow-outs and delays.

9.4 Production

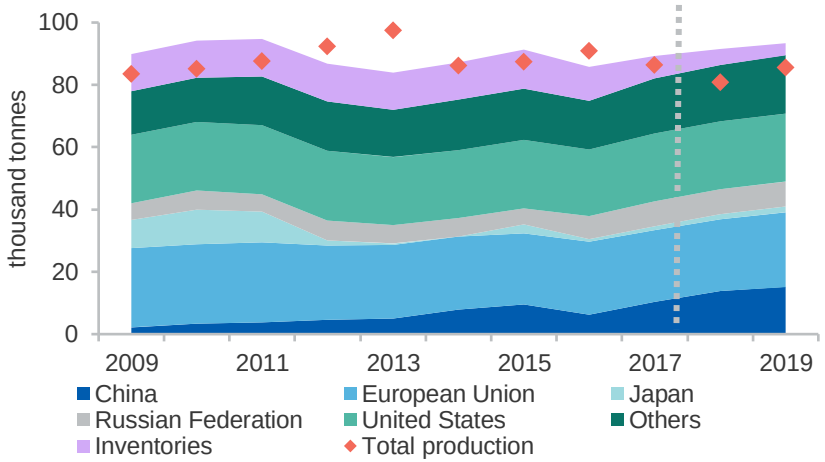
Mine production is falling, but inventories and secondary markets should constrain price growth

World primary production of uranium is estimated to have declined from 73,500 tonnes in 2016 to 69,400 tonnes in 2017, largely as a result of production cut-backs in Kazakhstan. A further large fall (to around 60,000 tonnes) is forecast for 2018. This follows announcements of an additional cut in Kazakhstan (where KazAtomProm will impose a 20 per cent output reduction for three years), and a freeze at the MacArthur River mine in Canada, where production will cease for 10 months from January 2018. MacArthur River accounts for more than 10 per cent of global mine output.

Several other production cuts also occurred in the December quarter. Areva announced plans to reduce uranium output from its Somair mine in Niger by 400 tonnes in 2018, with production at the nearby Cominak mine also under review. Both mines have production costs above $US30 a pound, making them uneconomic. A succession of other cuts and investment deferrals have also taken place in the US, Ukraine and Africa.

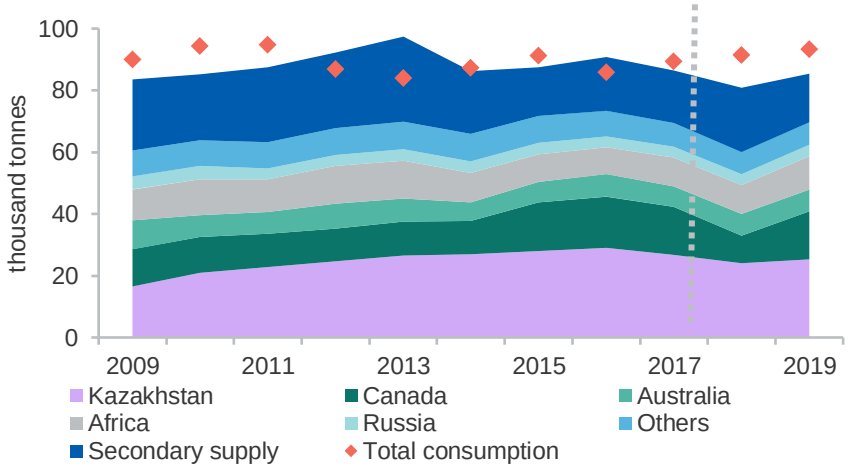
The effect of this tightening on prices and markets is likely to be somewhat muted. Production is expected to resume at MacArthur River in late 2018, leading to a rebound in mined supply to 69,600 tonnes in 2019.

Figure 9.4: World uranium consumption



Source: International Energy Agency (2017); World Nuclear Association (2017); Ux Consulting (2017)

Figure 9.5: World uranium production



Source: UX Consulting (2017) Uranium Market Outlook; World Nuclear Association (2017).

In the interim, any supply shortfall could be made up, in part, through increased supply from uranium enrichers in secondary markets. Cameco also plans to meet its sales commitments (which sum to around 13,000 tonnes per year) using inventories and output from its mine at Cigar Lake.

Although further cuts in production are still a strong prospect, the scale of uranium inventories (almost 1.5 billion pounds of inventories have been run up globally over the past 25 years) will help to cover the gap.

9.5 Australia's exploration, production and exports

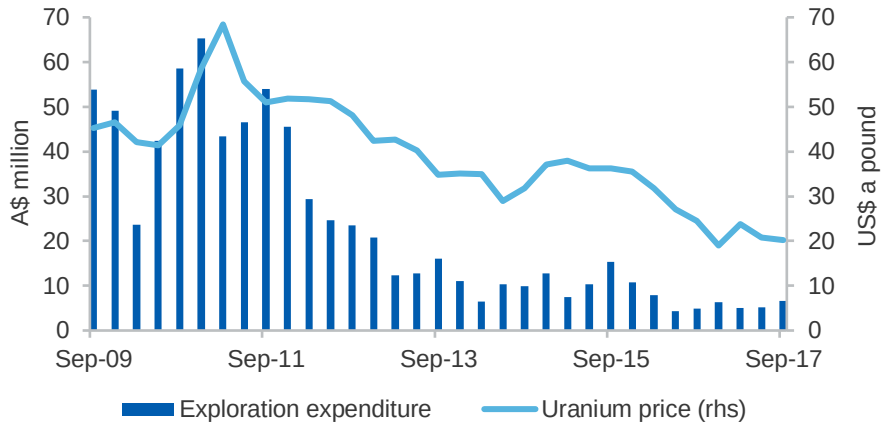
Australia's uranium exploration expenditure remains low

Australia's uranium exploration expenditure remains minimal, with $6.6 million invested during the September quarter. Exploration has risen marginally in quarterly and through-the-year terms, but remains well below the 2010-11 peak, when quarterly expenditure averaged over $50 million.

Production remains solid, as upgrades conclude at Olympic Dam

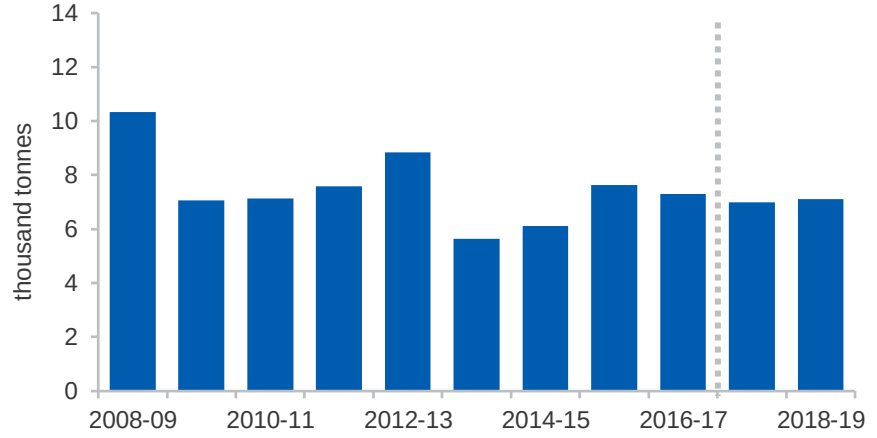
Australia's uranium production is forecast to decrease from 7,295 tonnes in 2016–17 to 6,990 tonnes in 2017–18, affected by the production pause at Olympic Dam. This production pause was timed to run until late November, with BHP seeking to expand capacity through major overhauls, including a rebuild of the slag and flash furnaces and the electro static precipitator. In 2018–19, a recommencement of production at Olympic Dam (and expansion of its capacity) is expected to support a rebound in Australian production to around 7,100 tonnes. Various uranium mine developments moved closer to completion in Australia during the December quarter. Boss Resources' Honeymoon project in South Australia is on a stronger footing following recent field leach trials, which demonstrated "historic high" uranium recovery levels of over 370 mg U3O8 per litre. This significantly reduces the costs and risks of the project. The ion exchange plant attached to the project also performed well during initial start-up. Boss has recently filed a Preliminary Feasibility Study for the project, bringing it closer to final approval.

Figure 9.6: Australia's uranium exploration



Source: ABS (2017) Mineral and Petroleum Exploration, cat. No. 8412.0; Cameco Corporation (2017) Uranium Spot Price

Figure 9.7: Australia's uranium production



Source: BHP (2017); Operational Review, DIIS (2017); Energy Resources of Australia (2017); ASX Announcements – Operations Review; company media announcements (2017)

Vimy Resources' Mulga Rock project also appears to have a higher resource deposit than previously thought, with ore reserves now estimated at more than 42 million pounds of U3O8. This is 36 per cent higher than the previous estimate, which was published in late 2016. Vimy's Definitive Feasibility Study is ongoing.

Prices are weighing heavily on exports, but there are "green shoots"

Export values fell to $A596 million in 2016–17, as a result of falls in the uranium price. Contract prices are expected to decline slightly in 2017–18, as some contracts expire. As a result, export revenue is expected to increase only marginally to $A636 million, despite the resumption of production at Olympic Dam.

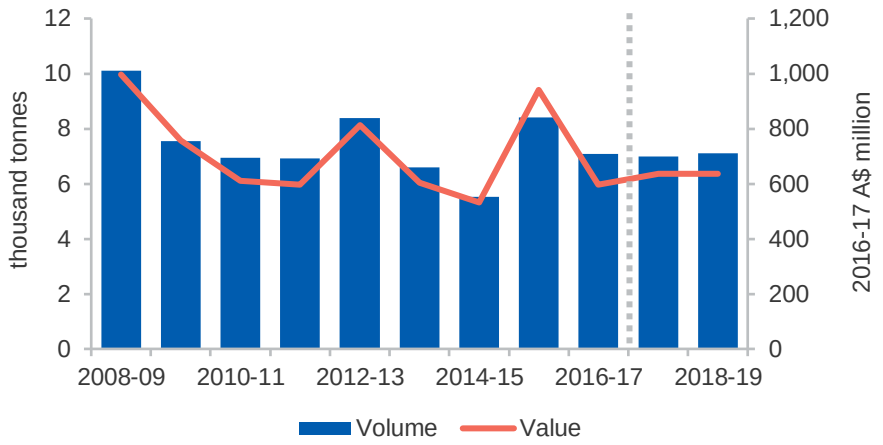
Export values are expected to be roughly stable in 2018–19, with some benefit from higher spot prices offset by the impact of an expected easing in production at ERA's Ranger mine (as it prepares to cease production by early 2021.)

Export earnings have been revised down from the previous *Resources and Energy Quarterly* forecast, reflecting a likely softening in the outlook for price growth.

As previously noted, the price outlook remains mixed, with spot prices expected to rise modestly while contract prices come under pressure. However, conditions for Australian exporters are likely to remain structurally difficult over the outlook period.

On the upside, competitors such as Canada and Kazakhstan have cut their production significantly, creating a chance to increase market share. However, global inventories remain high, and the expiration of supply contracts during 2017 and 2018 will see a larger share of global demand being met from the spot market. The current outlook for spot prices suggests marginal losses from uranium production in the Olympic Dam mine, and larger losses for other deposits.

Figure 9.8: Australia's uranium exports



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

Box 9.1: Nuclear power in the World Energy Outlook 2017

The International Energy Agency's World Energy Outlook (WEO) 2017 provides analysis and forecasting based on possible future pathways for energy markets. The 2017 edition includes several alternative scenarios:

- A Current Policies Scenario (CPS), in which energy policies already in effect remain intact, but no new policies are legislated.
- A New Policies Scenario (NPS), in which existing policies remain in effect, and announced policy intentions released following the Paris Agreement also proceed to implementation.
- A Sustainable Development Scenario (SDS), in which governments enact new policies not yet announced, in order to fully meet Paris targets and achieve the energy goals of the UN Sustainable Development Agenda.

Nuclear power will play an important role as a low-carbon energy source

Nuclear energy is a policy-sensitive industry, and figures from the WEO 2017 suggest different policy scenarios produce significantly varying outlooks.

Nuclear energy generation under alternative scenarios

	Historical		CPS		NPS		SDS	
	2000	2016	2025	2040	2025	2040	2025	2040
Generation (twh)	2,591	2,611	3,218	3,825	3,217	3,844	3,531	5,345
Share of total (per cent)	17	11	10	9	11	10	13	15

All scenarios predict a significant rise in output of nuclear energy as a result of rollouts announced by China and India. Although there is divergence between scenarios, all show an expansion in reactor constructions, with 60 new reactors expected by the mid-2020s.

Under the NPS, nuclear capacity increases significantly, but remains confined to a limited number of countries. China is expected to more than triple its capacity and become the leading nuclear power, while India becomes one of the top five generating countries. However, nuclear generation in the EU falls by around one-third by 2040, as a result of planned phase-downs in France, Germany and Belgium.

Under the SDS, pressure to build clean energy leads to much more substantial investment in nuclear generation. Modern nuclear reactors are highly dispatchable, meaning they can support renewable energy deployment by balancing volatile renewable energy generation. Nuclear power projections have been revised down in the WEO 2017. This is due to recent announcements by Korea and France of plans to scale back nuclear power, as well as financial difficulties among US nuclear providers, which will make it harder to replace aging reactors.

China is expected to be the main engine of growth nuclear power

China's Energy Revolution policy contains significant targets for expansion of nuclear power. This expansion builds on rapid recent progress in Chinese nuclear technology. A total of 58 reactors are planned or under construction, but the WEO 2017 notes that approvals for reactors further out have slowed, suggesting a peak to reactor growth within the next few years.

China has improved its technology, developing its own second- and third-generation pressurised water reactors. Nuclear technology has also become an important part of China's export policy. The China General Nuclear Power Corporation has built five reactors in Pakistan, with two more under construction. It has also recently signed a contract with Argentina to build two reactors, and is collaborating on projects in the UK. Discussions are also underway with Romania, South Africa, and Turkey.

China's imports of uranium will likely be crucial for miners and exporters. Currently, China imports around 7,000 tonnes of uranium per year from Australia, Canada, Kazakhstan, Namibia, Niger and Russia. This is expected to rise to between 12,000 tonnes and 16,000 tonnes by 2030.

Table 9.1: Uranium outlook

						Annual percentage change		
World	**Unit**	**2016**	**2017 f**	**2018 f**	**2019 f**	**2017 f**	**2018 f**	**2019 f**
Mine production	kt	73.5	69.4	60.0	69.6	-5.5	-13.6	16.0
Africa b	kt	8.6	9.1	9.2	10.9	5.7	0.9	17.7
Canada	kt	16.6	15.6	8.8	15.4	-5.8	-43.3	74.4
Kazakhstan	kt	29.0	26.7	24.0	25.4	-8.0	-10.0	5.6
Russia	kt	3.5	3.6	3.7	3.7	0.9	2.3	0.0
Consumption	kt	74.9	82.0	86.4	89.6	9.5	5.4	3.7
China	kt	6.3	10.4	13.9	15.2	65.6	33.0	9.5
European Union 28	kt	23.3	22.9	23.1	23.9	-1.7	0.7	3.5
Japan	kt	0.8	1.3	1.6	1.9	58.0	25.0	18.8
Russia	kt	7.4	8.0	8.0	8.0	7.8	0.6	-0.3
United States	kt	21.4	21.8	21.8	21.8	1.8	0.0	0.0
Price								
– nominal	US$/lb	25.6	21.8	27.2	28.9	-15.0	24.5	6.3
– real c	US$/lb	26.2	21.8	26.6	27.6	-16.7	21.9	4.0
Australia	**Unit**	**2015–16**	**2016–17 s**	**2017–18 f**	**2018–19 f**	**2016–17 s**	**2017–18 f**	**2018–19 f**
Mine production	t	7,623	7,295	6,990	7,100	-4.3	-4.2	1.6
Export volume	t	8,417	7,081	6,990	7,100	-15.9	-1.3	1.6
– nominal value	A$m	940	596	636	635	-36.6	6.7	-0.2
– real value d	A$m	976	608	636	620	-37.7	4.6	-2.5
Average price	A$/kg	111.7	84.2	91.0	89.5	-24.6	8.1	-1.7
– real d	A$/kg	115.9	85.9	91.0	87.4	-25.9	6.0	-4.0

Notes: **b** Includes Niger, Namibia, South Africa, Malawi and Zambia; **c** in 2017 US dollars; **d** in 2017–18 Australian dollars; **f** forecast.

Source: Department of Industry, Innovation and Science (2017); Cameco Corporation (2017); UX Consulting (2017) Uranium Market Outlook

Gold

Resources and Energy Quarterly December 2017

Australia is the **2nd largest** producer of gold in the world

288 tonnes

of gold produced by Australia in 2016–17

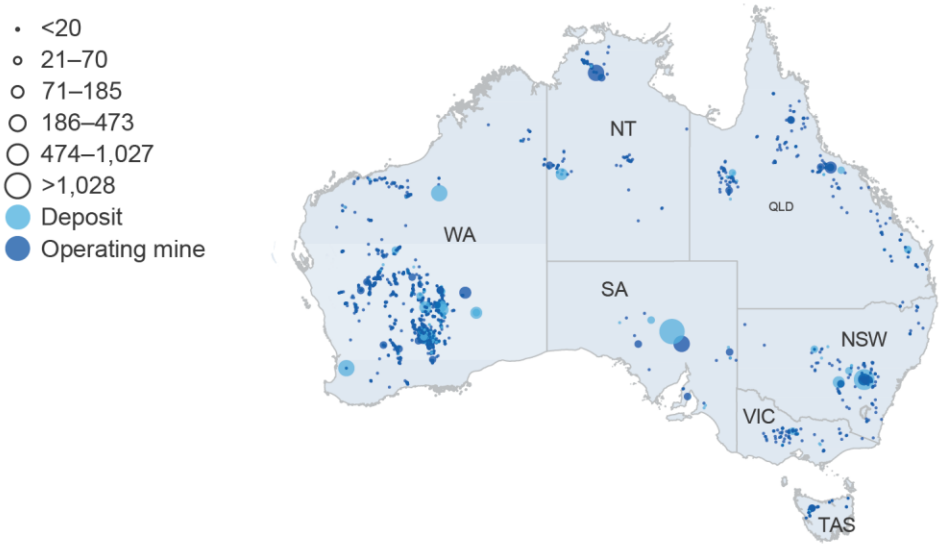
8.9%

of world mine gold supplied by Australia in 2016–17

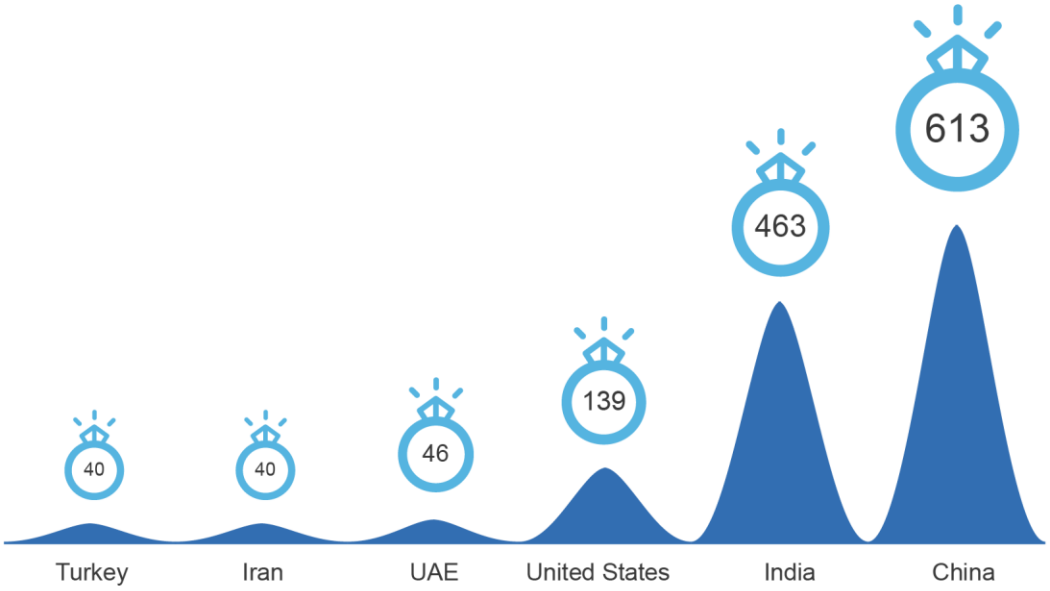
world record find

Australia holds the record for the world's largest gold nugget weighing 72 kg, found in Victoria in 1869

Major Australian gold deposits (t)



Key jewellery consumer markets (tonnes)



Global uses of gold

47%
Jewellery

24%
Gold coins and bars

12%
Gold backed Exchange Traded Funds

8.7%
Central Bank Reserves

7.1%
Electronics and Industrial

0.4%
Dental and medical

10.1 Summary

- Having averaged about US$1259 a troy ounce in 2017, the gold price is expected to average US$1,250 a troy ounce in 2018 and decline to US$1,205 a troy ounce in 2019.
- The fall in gold prices will be driven by rising real US Treasury bond yields, as the US Federal Reserve tightens monetary policy.
- The value of Australia's gold exports is forecast to decrease from $18 billion in 2016–17 to $17 billion in 2017–18 and $16 billion in 2018–19.

10.2 Prices

Gold prices were steady in December quarter of 2017

The London Bullion Market Association (LBMA) gold price averaged US$1,280 an ounce in the December quarter, virtually unchanged from US$1,278 an ounce in the September quarter. The gold price was steady as the downward pressure from a slight rise in the US dollar and real US Treasury bond yields was countered by persistent safe haven demand. In October, the US Federal Reserve commenced normalising its balance sheet by selling US Treasuries and mortgage-backed securities — purchased in the aftermath of the Global Financial Crisis (in an effort to lower interest rates). The Federal Funds rate was increased by a further 25 basis points in December. Both actions support higher US Treasury yields and a stronger US dollar, and contributed to weaker gold prices.

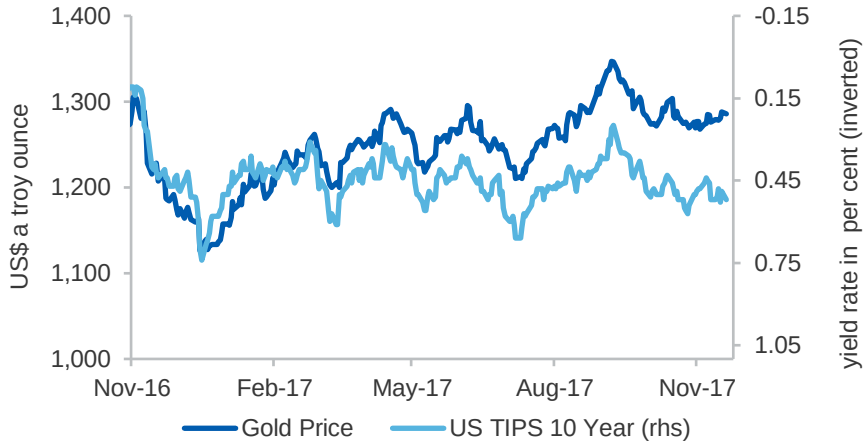
Gold prices expected to taper over the outlook

The LBMA gold price is forecast to steadily decrease to average US$1,205 a troy ounce in 2019. Real yields on 10 year US Treasury bonds are expected to average near one per cent over the next two years, propelled by rising official interest rates in the US. Investors widely anticipate the Federal Reserve increasing interest rates at least three times in 2018 — which will undermine gold prices as the opportunity cost of holding US Treasury bonds rises.

Investors remain cautious about the outlook for the global economy, equity prices and the political environment, which is expected to provide some support to gold prices over the near term. A correction in US equities and tighter credit conditions — driven by rising US interest rates — could spark increased demand for gold as a safe haven asset over the outlook period.

Gold has benefited from safe haven demand over the past year, as tensions rise between Western nations and North Korea: the gold price steadily outperformed the inflation-adjusted US bond yield during 2017, as North Korea conducted a series of missile tests, sparking retaliatory trade and financial sanctions by Western nations.

Figure 10.1: Gold prices and US Treasury bond yields



Source: LBMA (2017) Gold Price PM; Thompson Reuters (2017) US 10 year Treasury Income Protected Securities constant maturity middle rate.

10.3 World consumption

Global gold consumption is forecast to rise by 2.0 per cent annually over the forecast period, reaching 4,265 tonnes in 2019. Higher gold consumption will be supported by increased jewellery purchases and higher use in industrial fabrication, while the outlook for investment demand is likely to be somewhat more subdued.

Jewellery consumption expected to rise

Gold jewellery consumption decreased by 3.4 per cent year-on-year in the September quarter — weighed down by the introduction of tighter regulations around jewellery sales in India. The introduction of a Goods and Services Tax (GST) in July encouraged Indian consumers to bring forward gold jewellery purchases, hurting gold sales during the September quarter.

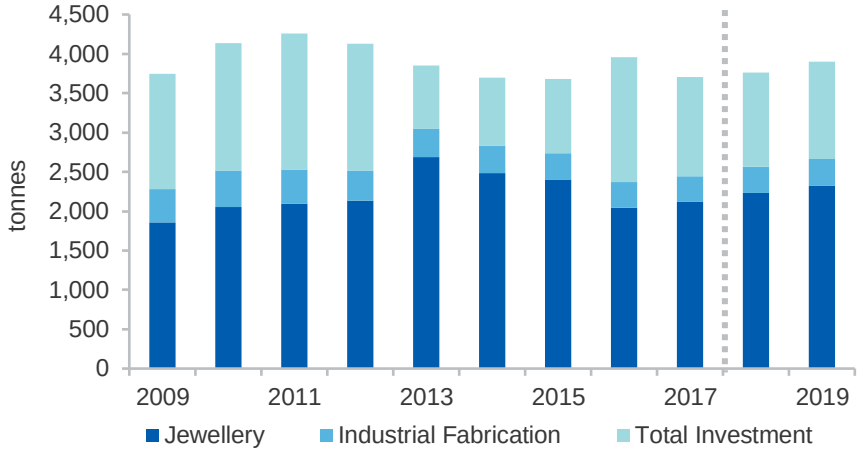
Gold jewellery consumption is forecast to increase by 4.8 per cent a year over the outlook period, lifting from around 2,117 tonnes in 2017 to 2,323 in 2019. Rising incomes in India and China — the world's two major jewellery markets — will support higher discretionary spending on gold throughout 2018 and 2019.

Industrial consumption continues to rise

Gold used in electronics rose by 2.0 per cent in the year to the September quarter — the fourth consecutive quarter of growth. Gold consumption in industrial applications is forecast to increase by 1.8 per cent annually over the outlook period, from 329 tonnes in 2017 to 342 tonnes in 2019.

Higher industrial demand will be underpinned by growth in demand for gold bonding wire used in memory chips, particularly for producing smartphones. Increased industrial consumption will also be driven by the use of gold in the production of sensor technology and LED lighting in the automotive industry.

Figure 10.2: Gold consumption by sector



Source: World Gold Council (2017) Gold Demand Trends Q3 2017; Department of Industry, Innovation and Science (2017)

Central bank purchases grew strongly in the September quarter 2017

Central bank buying increased by 25 per cent year-on-year in the September quarter, driven by increased purchases by Russia, Turkey and Kazakhstan — who together purchased over 100 tonnes of gold. Central bank purchases are forecast to taper over the outlook period, declining to 360 tonnes in 2019.

ETF holdings remained steady in the September quarter

Investors increased Exchange Traded Funds (ETF) holdings by 19 tonnes in the September quarter, representing an 87 per cent year-on-year decline due to an exceptional September quarter in 2016.

Total investment in gold — including gold bars, coins and bullion-backed Exchange Traded Funds (ETF) — is forecast to decrease by 7.9 per cent annually, from 1,587 tonnes in 2016 to 1,240 tonnes in 2019. Lower world gold prices will tend to discourage, rather than stimulate, investor demand over the outlook period.

10.4 World production

Total world gold supply is forecast to increase by 0.3 per cent annually in the outlook period, from 4,590 tonnes in 2016 to 4,630 tonnes in 2019. Higher total gold supply will be propelled by increased mine production, with scrap production forecast to be steady over the outlook.

Mine production expected to rise

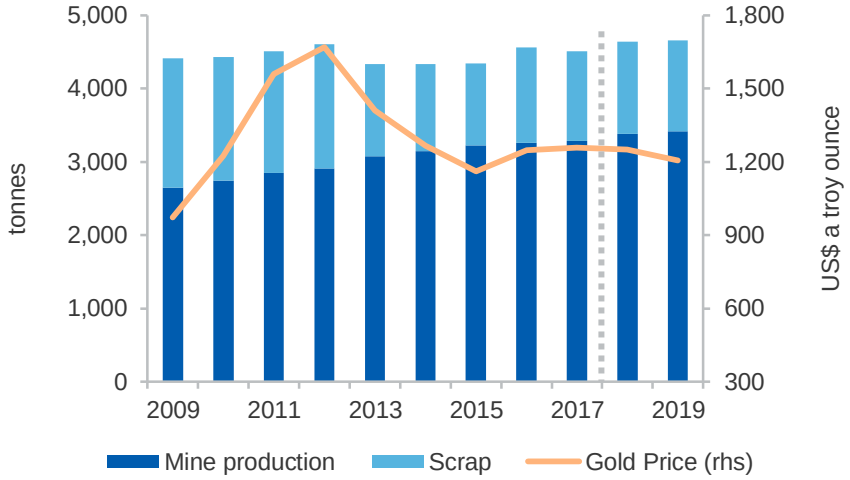
World mine production declined by 1.3 per cent year-on-year in the September quarter to 840 tonnes. Production was impacted by government restrictions on several gold mines in China, due to environmental breaches. China's efforts to reduce the discharge of cyanide tailings will likely disrupt gold production over the short term. Production was also lower in Tanzania, weighed down by a government-imposed ban on exports from Acacia Mining, which last year supplied 45 per cent of Tanzania's gold production. Mine production in Suriname increased by 90 per cent year-on-year in the September quarter, as Newmont's Merian mine ramps up to near full capacity.

World mine production is forecast to increase by 1.5 per cent annually in the forecast period, from 3,264 tonnes in 2016 to 3,413 tonnes in 2019. Several new projects are expected to add up to 100 tonnes to world mine supply in 2018, and a further 30 tonnes in 2019. Much of the expected additional supply comes from new projects, with only a small number of expansion projects in the pipeline.

Recycled supply falls in the first half 2017

World recycled supply declined by 5.8 per cent year-on-year in the September quarter of 2017, to 315 tonnes. The decline is largely due to exceptionally high production last year, when rising gold prices encouraged greater recycled supply. Recycled gold supply is forecast to rise marginally over the outlook, increasing by 0.8 per cent annually to 1,250 tonnes in 2019, hurt by the deteriorating gold price.

Figure 10.3: World gold supply and price



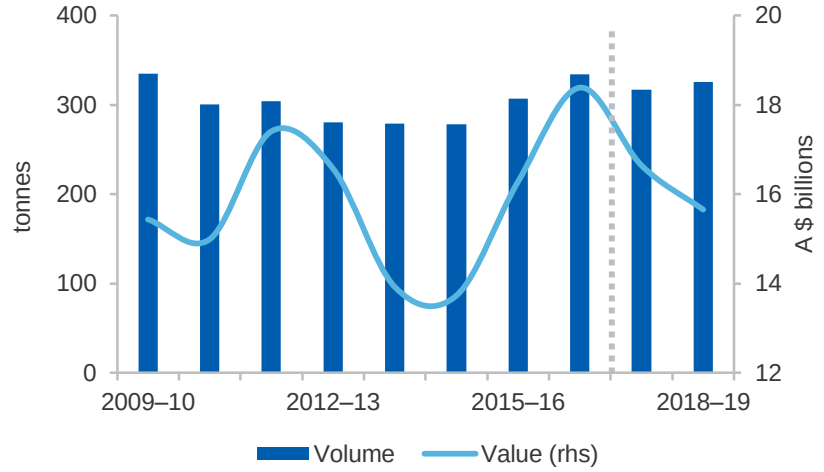
Source: World Gold Council (2017) Gold Demand Trends Q3 2017; Department of Industry, Innovation and Science (2017)

10.5 Australia's production and exports

Export values expected to taper in 2018–19

The value of Australia's gold exports is forecast to decrease from $18 billion in 2016–17 to $17 billion in 2017–18 and $16 billion in 2018–19. The modest fall in export values will be driven by lower gold prices offsetting higher local mine production. Export volumes are forecast to rise marginally over the outlook period, increasing from 334 tonnes in 2016–17 to 335 tonnes in 2018–19. Export volumes will be underpinned by higher local mine production in Western Australia and the Northern Territory. Export volumes will also be supported by imports of gold doré for refining, as production ramps up at the Ok Tedi mine in Papua New Guinea. The Australian gold price is forecast to decrease from an average of A$1,720 a troy ounce in 2016–17 to A$1,567 a troy ounce in 2018–19. The lower domestic price will be weighed down by lower world gold prices, with the AUD/USD exchange rate assumed to remain around A$0.77 over the outlook.

Figure 10.4: Australia's gold exports



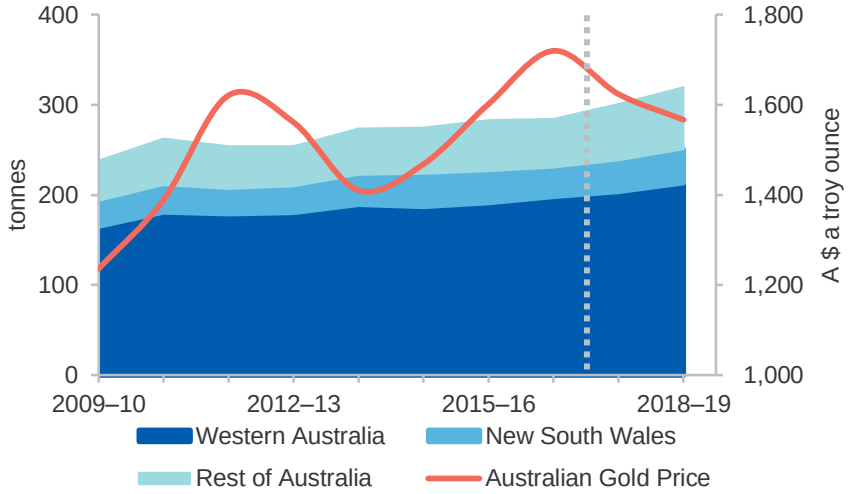
Source: ABS (2017) International Trade, 5464.0; Department of Industry, Innovation and Science (2017)

Improved outlook for Australian gold mine production

Australian gold mine production increased by 2.6 per cent year-on-year in the September quarter to 72 tonnes. Higher production was driven by increase output at several mines, including AngloGold Ashanti's Sunrise Dam and the Tropicana joint venture. Both mines increased production by 24 and 15 per cent, respectively, driven by higher mill throughput and higher ore grades at the Sunrise Dam operation. Higher ore grades at Fosterville, operated by Kirkland Lake Gold in Victoria, resulted in a 66 per cent year-on-year gain in the September quarter to 1.9 tonnes.

Australia's gold mine production is forecast to increase by 3.7 per cent annually, from 285 tonnes in 2016–17 to 306 tonnes in 2018–19. Higher mine production will be driven by the addition of new gold projects and mine expansions. Fosterville is expected to ramp up production further over 2017–18 and produce 8 tonnes. Dacian Gold's Mount Morgans project in Western Australia is expected to commence production in 2018 and produce 5 tonnes annually. The Gruyere joint venture currently under construction in Western Australia is expected to produce over 9 tonnes annually, commencing in the first quarter of 2019.

Figure 10.5: Australian gold production and price



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

Exploration expenditure continues to increase

Australia's gold exploration expenditure increased by 21 per cent year-on-year in the September quarter to $193 million. Australia's gold exploration expenditure increased by 26 per cent to $689 million in 2016–17, accounting for 44 per cent of Australia's total minerals exploration expenditure during the financial year. Gold exploration expenditure was supported by higher world gold prices. Western Australia remains the largest centre of gold exploration activity in Australia, accounting for $510 million of exploration expenditure. Expenditure increased in most States, reaching $51 million in Queensland and $46 million in New South Wales.

Table 10.1: Gold outlook

						Annual percentage change		
World	**Unit**	**2016**	**2017 s**	**2018 f**	**2019 f**	**2017 s**	**2018 f**	**2019 f**
Total demand	t	4,347	4,104	4,129	4,265	-5.6	0.6	3.3
Fabrication consumption b	t	2,370	2,447	2,569	2,665	3.3	5.0	3.7
Mine production	t	3,264	3,287	3,380	3,413	0.7	2.8	1.0
Price c								
Nominal	US$/oz	1,248	1,259	1,251	1,205	0.8	-0.7	-3.6
Real d	US$/oz	1,275	1,259	1,225	1,155	-1.2	-2.7	-5.7
Australia	**Unit**	**2015–16**	**2016–17 s**	**2017–18 f**	**2018–19 f**	**2016–17 s**	**2017–18 f**	**2018–19 f**
Mine production	t	283	285	293	306	0.5	3.0	4.4
Export volume	t	306	334	317	325	8.9	-5.0	2.6
Nominal value	A$m	15,687	18,013	16,641	16,010	14.8	-7.6	-3.8
Real value e	A$m	16,283	18,384	16,641	15,637	12.9	-9.5	-6.0
Price								
Nominal	A$/oz	1,602	1,720	1,624	1,567	7.4	-5.6	-3.5
Real e	A$/oz	1,663	1,755	1,624	1,530	5.6	-7.5	-5.8

Notes: **b** includes jewellery consumption and industrial applications; **c** London Bullion Market Association PM price; **d** In 2017 calendar year US dollars; **e** In 2017–18 financial year Australian dollars; **f** Forecast; **s** Estimate

Source: ABS (2017) International Trade, 5465.0; London Bullion Market Association (2017) gold price PM; World Gold Council (2017); Department of Industry, Innovation and Science (2017)

Aluminium, alumina and bauxite

Resources and Energy Quarterly December 2017

Australia's global ranking

1st — Alumina exporter

1st — Bauxite producer

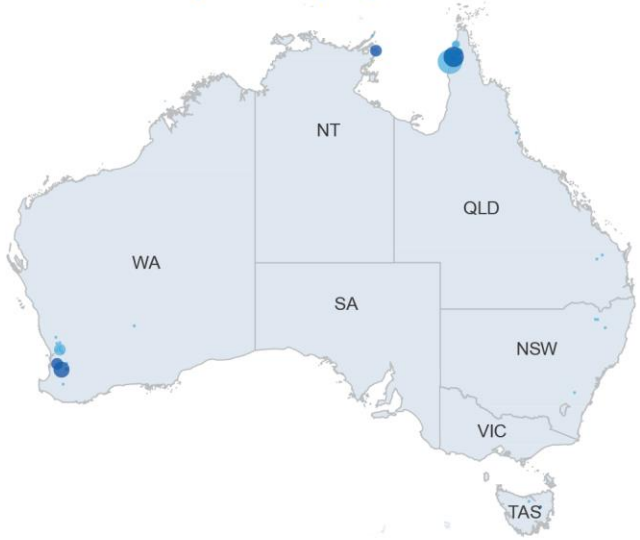
2nd — Alumina producer

3 stages of producing aluminium

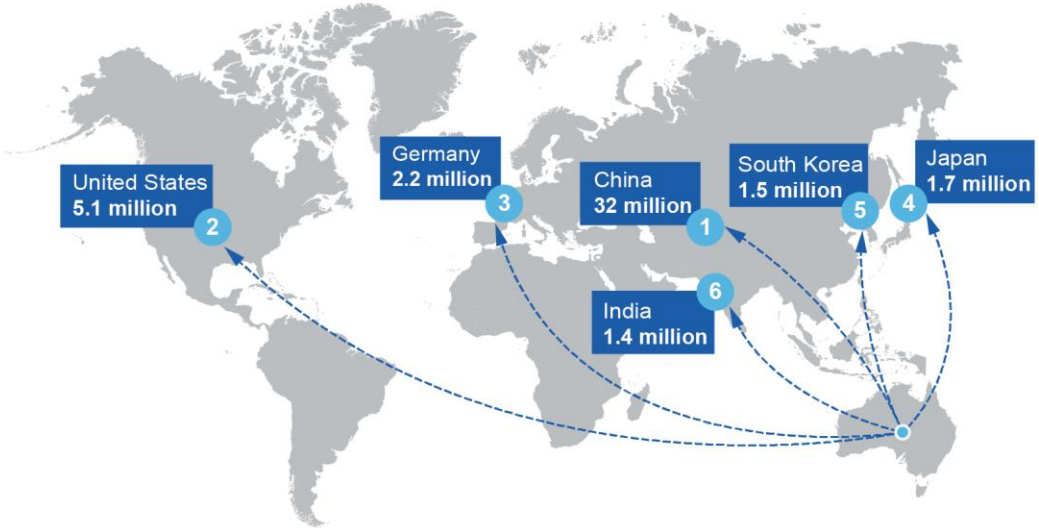
1. **Mining** bauxite ore
2. **Refining** to recover alumina
3. **Smelting** to make aluminium

Major Australian alumina deposits (Gt)

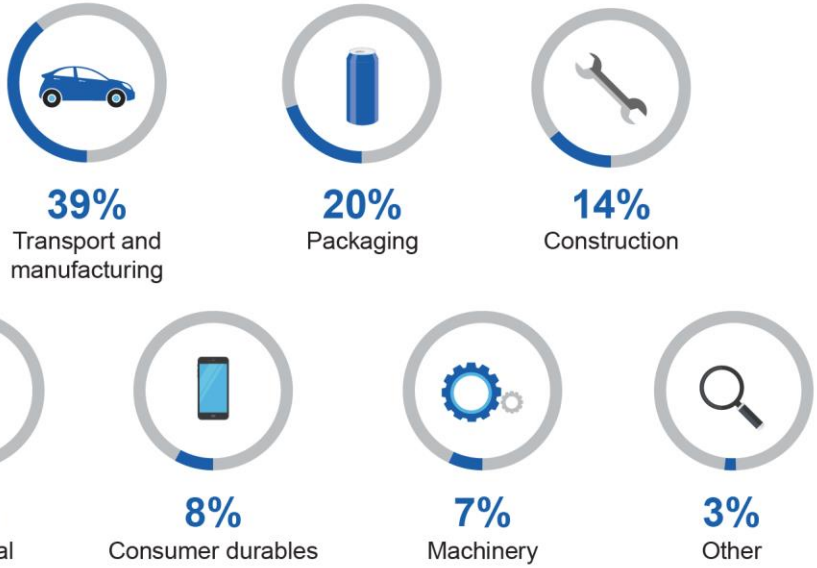
- <0.01
- 0.02–0.03
- 0.04–0.09
- 0.10–0.20
- 0.21–0.44
- >0.45
- Deposit
- Operating mine



Key consumer markets for aluminium (tonnes)



Global uses of aluminium



Aluminium

11.1 Summary

- The value of Australia's aluminium exports is forecast to increase by 19 per cent in 2017–18, to $3.8 billion, driven by high prices and stable export volumes.
- Crackdowns on air pollution and illegal capacity in China are likely to push aluminium prices higher in 2018 and 2019.

11.2 Prices

Aluminium prices forecast to grow strongly in 2018 and 2019

Increasing demand and declining supply in China — the world's largest aluminium consumer and producer — has contributed to a surge in the London Metal Exchange (LME) spot aluminium price in 2017. As at 29 December 2017, prices have increased by over 30 per cent from the start of 2017, to US$2,250 a tonne. Likely reflecting the Chinese production cuts, LME stocks decreased by 46 per cent from the beginning of 2017, falling to 1.1 million tonnes in late December 2017.

The rally in the aluminium price is expected to continue into 2018 and 2019, as the global aluminium market records a supply deficit of 2.8 million tonnes in 2019. A rise in raw material (alumina) prices will lift the global cost curve for aluminium producers, supporting higher aluminium prices.

Compared to the September 2017 *Resources and Energy Quarterly* aluminium prices have been revised up by 5.8 per cent for 2018 and 21 per cent for 2019, reflecting the Chinese Government's decision to extend its 'air pollution control' policy after the 2017–18 winter season. The average LME spot aluminium price is forecast to increase by 6.2 per cent to US$2,072 a tonne in 2018, and by a further 3.6 per cent to US$2,146 a tonne in 2019.

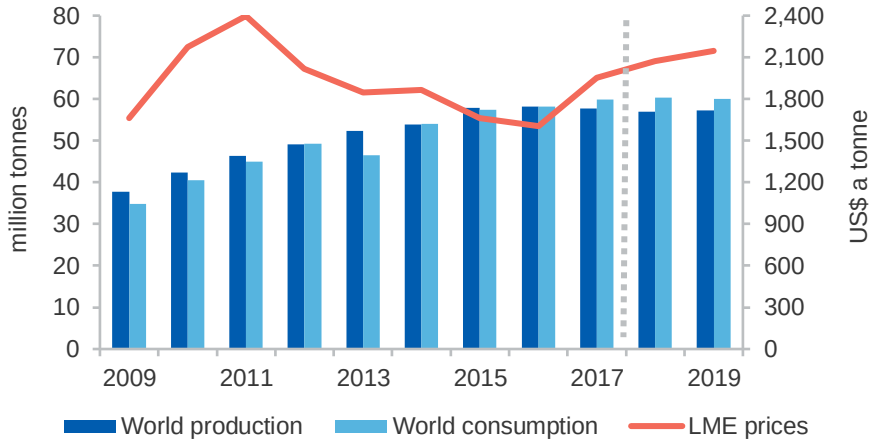
The risk to the price forecast is the level conformity of Chinese aluminium smelters to China's environmental and illegal capacity policies. Some Chinese smelters, such as Weiqiao and Xinfa, have pushed for illegal capacity cuts to be included in winter curtailment volumes. If the Chinese Government pursues this option, aluminium winter cuts in China will be smaller than previously estimated. As new capacity is added, the lack of a substantial winter production curtailment will put downward pressures on aluminium prices in 2018 and 2019.

11.3 World consumption

World aluminium consumption to remain growing

World aluminium consumption increased by 4.3 per cent year-on-year in the first nine months of 2017, to 45 million tonnes. Growth was propelled by demand from China, which grew by 5.2 per cent year-on-year. Demand from China's packaging sector rose by 20 per cent, while demand from real estate, transportation and electronic products grew by 8 per cent, and demand from the power sector by 5 per cent.

Figure 11.1: World aluminium production, consumption and prices



Source: LME (2017) spot prices; International Aluminium Institute (2017); Department of Industry, Innovation and Science (2017)

Vehicle demand remains key to Chinese demand for aluminium, and is expected to stay strong in 2017 as Chinese consumers seek to buy vehicles before the scheduled increase in the tax rate from 7.5 to 10 per cent in January 2018. China's real estate sales continued to grow, while new development investment moderates. As a result, global aluminium consumption is forecast to increase by 3.0 per cent in 2017, to 60 million tonnes.

Global industrial production — a driver of commodity demand — is forecast to grow by 3 per cent a year in 2018 and 2019. Aluminium consumption growth is likely to be firm, supported by an expected rise in Chinese demand (which is outgrowing the country's GDP), and rising global vehicle sales. The trend towards electric cars is likely to increase the aluminium content of vehicles, as carmakers seek to maximise battery range. As a result, world aluminium consumption is forecast to increase by 1.0 per cent in 2018, to over 60 million tonnes, and stay at this level in 2019.

11.4 World production

China's pollution crackdowns reduce world aluminium production

World aluminium production increased by 2.8 per cent year-on-year in the first ten months of 2017, to reach over 51 million tonnes. This was driven by strong growth in China (up 4.8 per cent year-on-year). Chinese aluminium producers have tried to compensate for the winter 2017–18 production cut by increasing output before November 2017. Likely reflecting this increased output, Shanghai aluminium stocks reached a 54-month high at the end of September 2017, at 490,000 tonnes.

The total production cut from the winter curtailment and illegal aluminium capacity policies is estimated to be around 7 million tonnes in 2017. Strict enforcement of production cuts — targeting active rather than just idled capacity — that is not fully offset by new capacity, is likely to lead to a material decline in Chinese aluminium production, which is expected to fall by 4.6 per cent to 30 million tonnes. It also deepened the global aluminium deficit (estimated at 2 million tonnes) in 2017. An expected 16 per cent rise in aluminium production in other Asian countries may act as a partial offset to cuts in China. As a result, global aluminium production is forecast to have declined by just 0.7 per cent in 2017, to 56 million tonnes.

China's pollution crackdown is expected to continue, following an announcement by Chinese Environment Minister at a press conference during the Communist Party's 19th National Congress, in October 2017. This decision is likely to intensify production cuts in China, and was seen as necessary not only to curb air pollution, but also to offset new capacity additions and idled capacity restarts — estimated around 3 million tonnes per year. Other Asian countries are expected to act as the engine of global production growth — notably Iran, which is aiming to increase its annual aluminium production from 450,000 tonnes to 1.5 million tonnes by 2025.

World production is forecast to decrease by 1.4 per cent in 2018, to 57 million tonnes, and to remain at this level in 2019. This is a downward revision of 5.8 million tonnes from the forecast in the September 2017 *Resources and Energy Quarterly*, taking into account the latest development in China's pollution crackdowns.

The Chinese Government is expected to remove the winter curtailment policy by 2020, since more than three years of winter curtailment would cause damage to the aluminium cells and increase restart costs.

China is both the world's largest producer and consumer of aluminium, but Hongqiao Group — the world's largest aluminium producing company – could find its expansion in China limited by state policy. The company is reviewing the feasibility of moving shuttered illegal smelting capacity overseas, mainly to Indonesia.

11.5 Australia's exports and production

Aluminium exports to rise strongly in 2017–18

Higher aluminium prices and larger export volumes contributed to a 19 per cent year-on-year rise in export values in the first quarter of 2017–18, to $952 million. The LME spot aluminium price reached a five year high on

20 October 2017, at US$2,159 a tonne. Export volumes rose by 1.3 per cent year-on-year in the September quarter 2017 to 367,000 tonnes, supported by improved production capacity from Portland aluminium smelter.

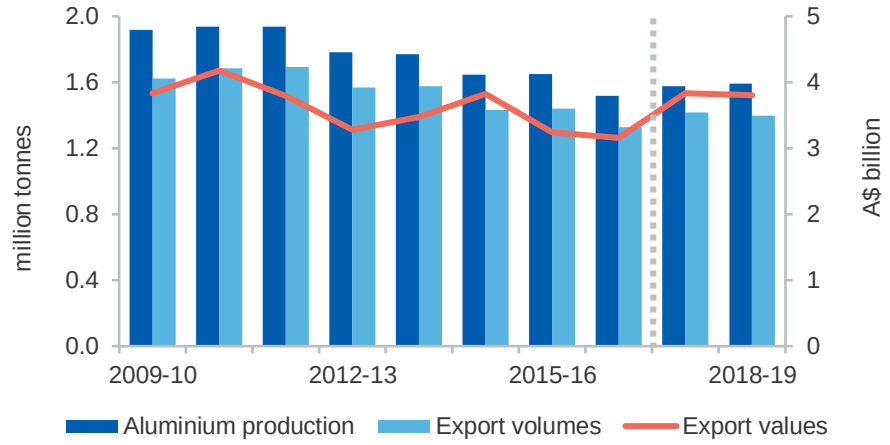
The trend of high prices and sustained export volumes is likely to continue in 2017–18 and 2018–19, as China's crackdowns on air pollution and illegal capacity show no sign of ending. Portland Aluminium is expected to return to full capacity, following a power outage in December 2016. As a result, Australia's aluminium exports are forecast to increase by 19 per cent in 2017–18 to $3.8 billion, and to remain at this level in 2018–19. Export volumes are estimated to return to the normal annual export capacity level of 1.4 million tonnes.

Australia's aluminium production has recovered from Portland Aluminium's power outage incident, and is likely to remain at full annual production capacity of 1.6 million tonnes in 2017–18 and 2018–19. There are no expected major additions or closures to capacity over the forecast period.

Australia and other aluminium smelters in the Oceania region use a variety of power sources — coal, natural gas, hydroelectricity and other renewable energy — to produce primary aluminium. Coal and hydroelectricity are the main sources, accounting for around 73 and 27 per cent of total power consumption, respectively. Natural gas and other renewable energy sources have emerged as alternatives to hydroelectricity and coal, but are still not a very popular choice — accounting for just 0.7 per cent of power generation in 2016.

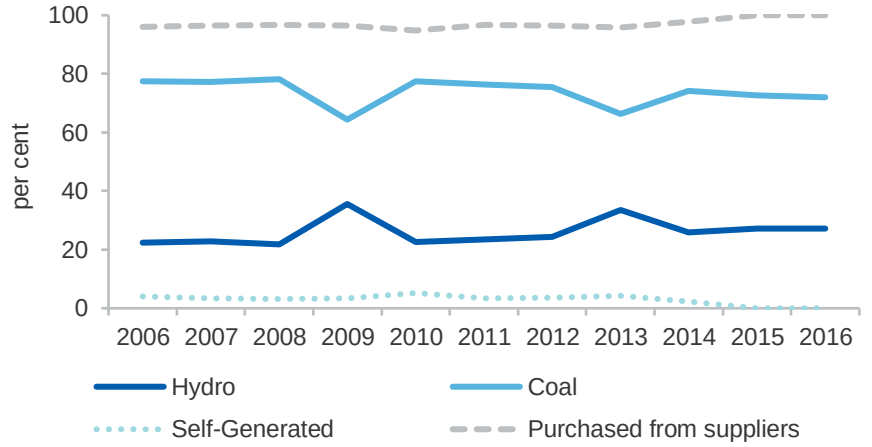
Aluminium smelters in the Oceania region have always been dependent on energy suppliers to power their smelting plants. About a decade ago, around 4 per cent of power was self-generated by aluminium smelters. However, the self-sufficient power supply option is no longer viable, due to building and running cost pressures. Since 2015, all aluminium smelting power has been sourced and purchased from energy suppliers.

Figure 11.2: Australia's aluminium exports and production



Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Figure 11.3: Aluminium smelting power consumption - Oceania



Source: International Aluminium Institute (2017)

Alumina

11.6 Summary

- The value of Australia's alumina exports is forecast to increase by 11 per cent in 2017–18, to $7.4 billion, driven by high alumina prices in 2017.
- Continued crackdowns on air pollution and illegal capacity in China are likely to push alumina prices and exports lower in 2018 and 2019.

11.7 Prices

Alumina prices forecast to come under pressure in 2018 and 2019

Rising world aluminium production, particularly in China, has boosted alumina demand and prices in 2017. The average FOB Australia alumina price was US$469 a tonne in October 2017, up 37 per cent from the start of the year. In the first nine months of 2017, Chinese aluminium smelters ramped up production (resulting in a 6 per cent rise year-on-year), ahead of the 2017–18 winter curtailment. Over this period, aluminium production in other Asian countries increased by 6 per cent year-on-year. Demand for alumina is likely to have declined in November and December, as the winter production cuts in China took effect from 15 November 2017. Despite this fall, the alumina price is estimated to have increased by 28 per cent in 2017, averaging US$324 a tonne.

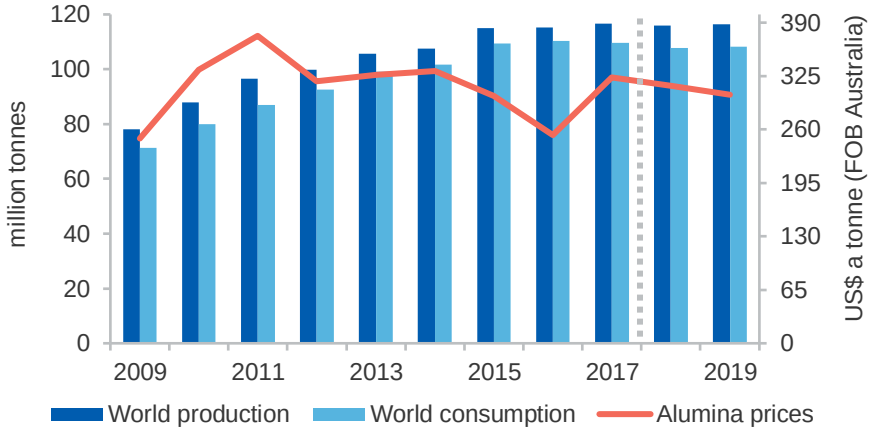
The FOB Australia alumina price is forecast to come under pressure over the outlook period, falling around 3 per cent a year, to $US313 a tonne in 2018 and US$302 a tonne in 2019. The continuation of environmental crackdowns in China over coming years is likely to decrease world aluminium production by 1.4 per cent in 2018, thereby pushing alumina demand down by 1.7 per cent. New capacity additions in China and other major alumina producing countries are expected to contribute to lower alumina prices. It is projected that China, India and the UAE will add nearly 10 million tonnes of refinery capacity in 2018.

11.8 World consumption

Reduction in alumina consumption in line with aluminium output

World alumina consumption increased by 4.8 per cent year-on-year in the first nine months of 2017, to 85 million tonnes, propelled by strong growth in aluminium production in China (up 6.1 per cent year-on-year). Demand for alumina is likely to have declined in the last two months of 2017, due to winter aluminium production cuts in China. For 2017 as a whole, world alumina consumption is forecast to have declined by just 0.5 per cent, to 110 million tonnes, as strong consumption growth in the first ten months of 2017 offset an expected decrease in alumina consumption in November and December 2017.

Figure 11.4: World alumina production, consumption and prices



Source: Bloomberg (2017) Alumina monthly price; International Aluminium Institute (2017); Department of Industry, Innovation and Science (2017)

The extension of the air pollution crackdown policy after the 2017–18 winter season is likely to reduce global demand for alumina in 2018 and 2019. China's alumina demand is forecast to fall by 3.7 per cent in 2018, to 57 million tonnes. Offsetting China's slowdown is an expected increase in alumina consumption from the Middle East (up by 7 per cent in 2018,

and by 4 per cent in 2019). Iran plans to increase its aluminium production by 300 per cent within eight years, from 450,000 tonnes to 1.5 million tonnes by 2025 – creating more alumina demand. As a result, world alumina consumption is forecast to decrease by just 1.7 per cent in 2018, to 108 million tonnes, and to remain at this level in 2019.

Reflecting the Chinese Government's decision to extend 'air pollution control' policy after the 2017–18 winter season, world alumina consumption has been revised down by 11 million tonnes from the forecast in the September 2017 *Resources and Energy Quarterly*.

11.9 World production

Alumina production to fall in 2018 and 2019

World alumina production increased by 13 per cent year-on-year in the first ten months of 2017, to 106 million tonnes, propelled by very strong growth in China (up 12 per cent year-on-year) and other Asian countries (up 29 per cent year-on-year). Chinese refineries boosted their production output in anticipation of production cuts in the 2017–18 winter season. Outside of China, other Asian refineries maximised their output to take advantage of rising alumina prices. However, production is expected to fall in the December quarter 2017, due to production cuts in China. As a result, world alumina production is estimated to increase by 1.0 per cent in 2017 to 116 million tonnes.

Global alumina production is forecast to decrease by 0.7 per cent in 2018, to 116 million tonnes, and to remain at this level in 2019. China's alumina production is expected to fall by 9.5 per cent in 2018, to 61 million tonnes, as the Chinese Government continues to carry out its environmental crackdowns. However, production in ex-China countries is expected to rise. In India, Vedanta has obtained permission from the Odisha State Government to expand its Lanjigarh Alumina refinery from 1 million tonnes per annum to 6 million tonnes per annum. In Tajikistan, the 500,000 tonne a year Tursunzoda alumina refinery project is expected to come online in the first-half of 2019. In Jamaica, China's Jiuquan Iron and Steel Company has invested US$3 billion to expand production capacity at its Alpart alumina plant from 1.65 to 2.0 million tonnes per annum by 2020.

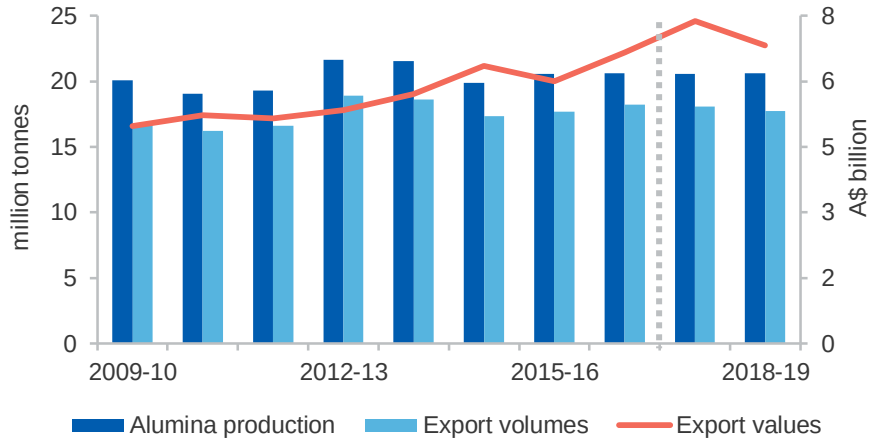
World alumina production has been revised down by 4 million tonnes lower from the forecast in the September 2017 *Resources and Energy Quarterly* — reflecting an expected extension of the air pollution control and illegal capacity policy after the 2017–18 winter season.

11.10 Australia's exports and production

Alumina exports to rise strongly in 2017–18, but fall modestly in 2018–19

Higher alumina prices contributed to a 28 per cent year-on-year rise in export values in the first quarter of 2017–18, to $1.8 billion. Over this period, alumina prices increased by 44 per cent year-on-year, to average US$338 a tonne. Export volumes fell by 4 per cent year-on-year, to 4.3 million tonnes. China imported 403,000 tonnes of alumina from Australia in the September quarter 2017 — a rise of 48 per cent year-on-year. Australia is the largest exporter of alumina to China, accounting for 48 per cent of China's total alumina imports.

Figure 11.5: Australia's alumina exports and production



Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Due to an expected weaker decline in demand from China in 2018, alumina prices are forecast to decrease by around 3 per cent from the 2017 level. However, with a strong growth in alumina exports in the first half of 2017–18, the impact of lower prices and export volumes is forecast to be minimal. As a result, Australia's alumina exports are estimated to rise by 11 per cent in 2017–18 to $7.4 billion. The revised export value is $400 million lower than the previous forecast.

In 2018–19, the full impact of China's reforms are expected to materialise on Australia's alumina exports. Alumina prices are forecast to drop by 3 per cent. Export volumes are forecast to fall by 2 per cent to under 18 million tonnes. As a result, export values are forecast to decrease by 7.5 per cent to $6.8 billion.

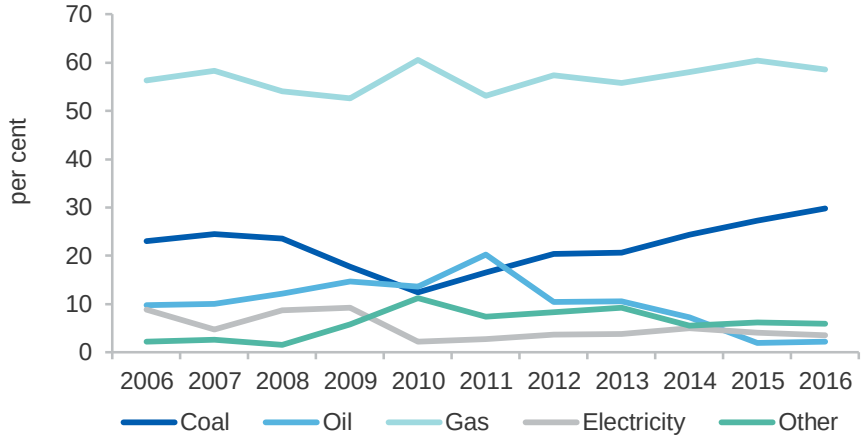
Australia's alumina export values in 2018–19 have been revised down, and are now $442 million lower than the forecast in the September 2017 *Resources and Energy Quarterly.* The revision reflects an expected reduction in Chinese demand.

For 2017–18 and 2018–19, Australia's alumina production is forecast to remain steady at 21 million tonnes, with no planned closures/expansions or major disruptions expected at existing operations. Rio Tinto has added two Queensland alumina refineries to its 2013 Project Lego — a plan to sell its downstream business (alumina refinery and aluminium smelting).

Australia and other alumina refineries in the Oceania region use a variety of energy sources — coal, oil, gas, electricity and other — to process raw bauxite into alumina. Gas and coal are the main sources, accounting for 59 and 30 per cent of total energy consumption, respectively. The use of coal is increasingly popular, rising from 12 per cent in 2010 to 30 per cent in 2016. In contrast, alumina refineries in the Oceania region have moved away from using oil as a source of energy to refine bauxite — with the share falling from 20 per cent in 2011 to 2 per cent in 2016.

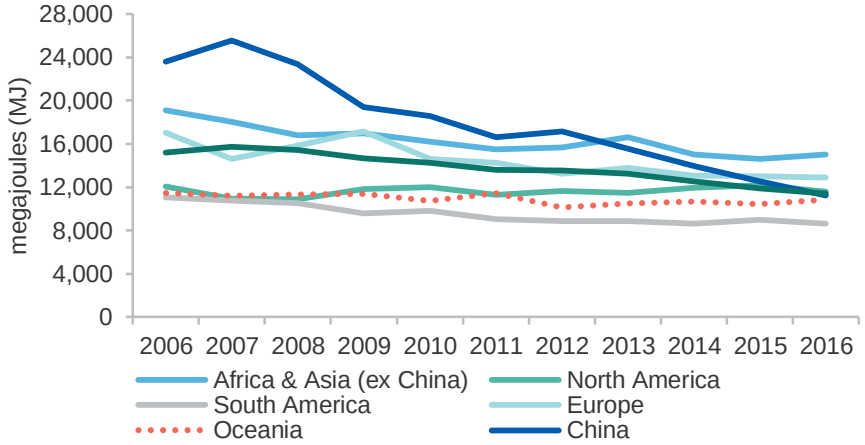
Refiners in Oceania (particularly Australia) consume less energy to refine bauxite and produce alumina than those in Africa, Asia, China, Europe, North America and the world as a whole. Lower energy use leads to better competitiveness for Australian refineries.

Figure 11.6: Alumina refining fuel consumption - Oceania



Source: International Aluminium Institute (2017)

Figure 11.7: Energy consumed to produce a tonne of alumina (MJ)



Source: International Aluminium Institute (2017)

Bauxite

11.11 Summary

- Lower volumes are expected to reduce the value of Australia's bauxite exports by 2.1 per cent to around $1.0 billion in 2017–18.
- Crackdowns on air pollution and illegal capacity in China are likely to reduce bauxite demand in 2018 and 2019.

11.12 World production

World bauxite production to rise strongly in 2018 and 2019

Over the first nine months of 2017, world bauxite production increased by 8.1 per cent year-on-year, reaching 220 million tonnes. This was driven by strong growth in Africa (up 53 per cent year-on-year), and Australia (up 3.9 per cent year-on-year). However, production in China — the world's second largest bauxite producer — fell by 6.5 per cent year-on-year, to just under 46 million tonnes.

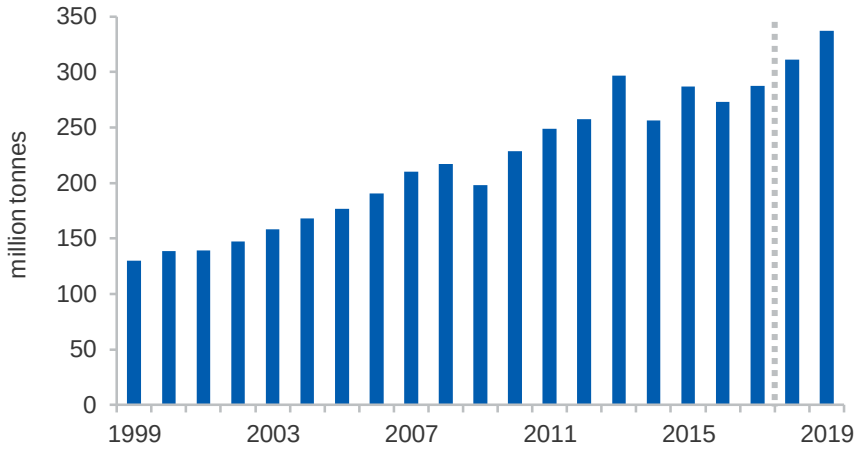
The environmental crackdown by the Chinese Government on aluminium and alumina smelter emissions during the 2017–18 winter season is likely to reduce China's bauxite production by 10 per cent in 2017, to 58 million tonnes. Lower Chinese domestic production and higher imports are expected to continue in the coming years. Offsetting the fall in Chinese production is an expected rise in bauxite output from Australia (up by 1.7 per cent), and Guinea (up 38 per cent). For 2017 as a whole, world bauxite production is forecast to rise by 5.5 per cent to 287 million tonnes.

World bauxite production is forecast to grow at an annual rate of 8 per cent in 2018 and 2019, to reach 337 million tonnes by the end of the outlook period. The gains will be driven by new capacity in Australia — notably the commissioning of Bauxite Hill and Amrun projects — and in Africa. Africa's bauxite production is forecast to reach 70 million tonnes by 2019, with Guinea expected to be the world's fourth largest bauxite producer and the largest bauxite producer in Africa.

Australia-based Alliance Mining Commodities is expected to bring its Koumbia bauxite mine online in Guinea in 2019. This mine holds an estimate 300 million tonnes of bauxite reserves, with an expected output of ten million tonnes per annum.

Indonesia is also expected to contribute to global bauxite production growth, following the relaxation of bauxite mining and export bans in early 2017.

Figure 11.8: World bauxite production



Source: World Bureau of Metal Statistics (2017); Department of Industry, Innovation and Science (2017)

11.13 Australia's exports and production

Bauxite exports lower in 2017–18

Larger export volumes contributed to a 3.7 per cent year-on-year rise in export values in the first quarter of 2017–-18. Export values are expected to reach $276 million for the quarter. China was the largest bauxite exporting market, accounting for 96 per cent (or 6.9 million tonnes) of total Australian bauxite exports. Chinese refineries' strategy of maximising

alumina production ahead of the 2017–18 winter production cuts was the main catalyst for this increased bauxite demand.

The extension of air pollution crackdowns for several more years is expected to decrease alumina production and bauxite demand in China. This has contributed to a downward revision in export earnings, with Australia's bauxite exports now revised down by $113 million a year in 2017–18 and 2018–19, to around $1.0 billion.

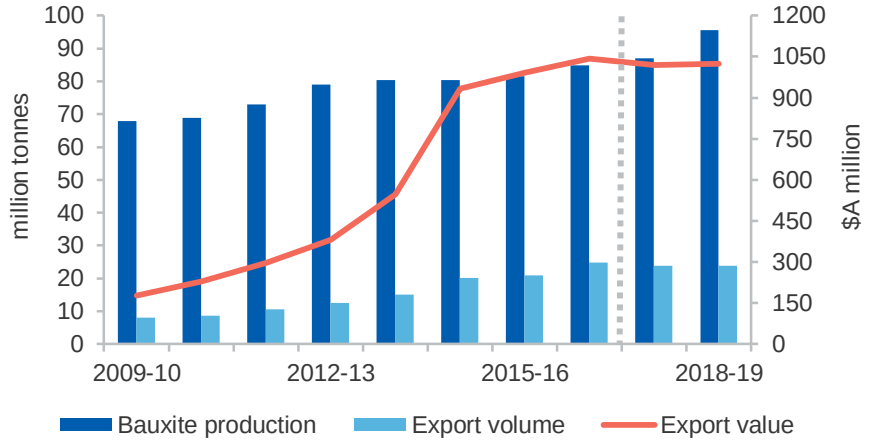
Hongqiao Group of China, the world's largest aluminium producing company, is rapidly expanding bauxite exports from Guinea into China. The company has established a transport network with logistic companies in order to source bauxite from Guinea, Malaysia and Indonesia to take advantage of low transport costs. This will challenge Australia's dominant position in global bauxite exports.

In Malaysia, the Government's attempts to target corruption among bauxite miners appears to be working. Bauxite exports to China fell by 44 per cent from 2.3 million tonnes in the June quarter 2017 to 1.3 million tonnes in the September quarter.

Australia produced 22 million tonnes of bauxite in the September quarter 2017, up 4.9 per cent year-on-year. All bauxite mines recorded year-on-year growth, underpinned by strong performances at Rio Tinto's Gove (up 11 per cent) and Weipa (up 3.3 per cent) operations. Australia's bauxite production is expected to rise by 2.4 per cent to 87 million tonnes in 2017–18, and then by a further 10 per cent to 96 million tonnes in 2018–19. Production over this period is expected to be buoyed by new capacity from the Bauxite Hills and Amrun projects.

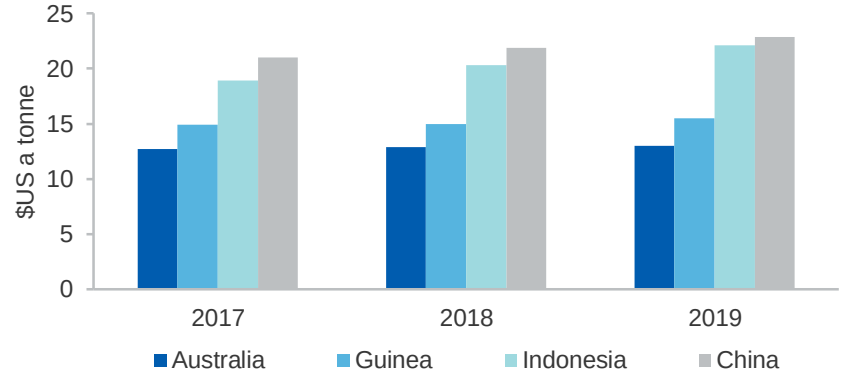
Australia's bauxite production costs are very competitive, and much lower than other major bauxite-producing countries, such as China, Guinea and Indonesia. On average, production costs in Australia are 13 per cent lower than Guinea, 32 per cent lower than Indonesia, and 38 per cent lower than China.

Figure 11.9: Australia's bauxite exports and production



Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Figure 11.10: Bauxite average total cash costs by country



Note: Average total cash costs include mining and crushing, administration and transport costs.

Source: AME Group (2017)

Table 11.1: Aluminium, alumina and bauxite outlook

						Annual percentage change		
World	**Unit**	**2016**	**2017 f**	**2018 f**	**2019 f**	**2017 f**	**2018 f**	**2019 f**
Primary aluminium								
Production	kt	58,158	57,748	56,921	57,223	-0.7	-1.4	0.5
Consumption	kt	58,099	59,839	60,390	60,076	3.0	0.9	-0.5
Closing stocks b	kt	2,762	2,196	2,152	2,134	-20.5	-2.0	-0.8
– weeks of consumption		7.5	5.4	2.4	1.2	-27.0	-55.3	-50.0
Prices aluminium c								
– nominal	US$/t	1,604	1,951	2,072	2,146	21.6	6.2	3.6
– real d	US$/t	1,638	1,951	2,028	2,056	19.1	4.0	1.4
Prices alumina spot								
– nominal	US$/t	253.2	323.7	313.0	302.1	27.9	-3.3	-3.5
– real d	US$/t	258.5	323.7	306.5	289.4	25.2	-5.3	-5.6
Australian production	**Unit**	**2015–16**	**2016–17**	**2017–18f**	**2018–19 f**	**2016–17**	**2017–18 f**	**2018–19 f**
Primary aluminium	kt	1,649	1,518	1,577	1,590	-7.9	3.9	0.8
Alumina	kt	20,550	20,599	20,586	20,640	0.2	-0.1	0.3
Bauxite	Mt	81.5	84.9	86.9	95.6	4.2	2.4	10.0
Consumption								
Primary aluminium	kt	207	190	161	191	-8.2	-15.5	18.8
Exports								
Primary aluminium	kt	1,442	1,329	1,416	1,400	-7.8	6.5	-1.2
– nominal value	A$m	3,241	3,165	3,790	3,806	-2.3	19.7	0.4
– real value e	A$m	3,364	3,231	3,790	3,722	-4.0	17.3	-1.8
Alumina	kt	17,676	18,230	18,050	17,717	3.1	-1.0	-1.8
– nominal value	A$m	5,995	6,655	7,199	6,825	11.0	8.2	-5.2
– real value e	A$m	6,223	6,792	7,199	6,674	9.1	6.0	-7.3
Bauxite	Kt	20,971	24,851	23,773	23,910	18.5	-4.3	0.6
– nominal value	A$m	992	1,042	1,020	1,023	5.1	-2.1	0.3
– real value e	A$m	1,030	1,063	1,020	1,000	3.3	-4.1	-1.9
Total value								
– nominal	A$m	10,228	10,863	12,009	11,655	6.2	10.5	-2.9
– real e	A$m	10,617	11,086	12,009	11,396	4.4	8.3	-5.1

Notes: **b** Producer and LME stocks; **c** LME cash prices for primary aluminium; **d** In 2017 calendar year US dollars; **e** In 2017-18 financial year Australian dollars; **f** Forecast

Source: ABS (2017) International Trade in Goods and Services, 5368.0; AME Group (2017); LME (2017); Department of Industry, Innovation and Science (2017); International Aluminium Institute (2017); World Bureau of Metal Statistics (2017)

Copper

Resources and Energy Quarterly December 2017

Australia is the world's **3rd largest exporter** of copper ores and concentrates

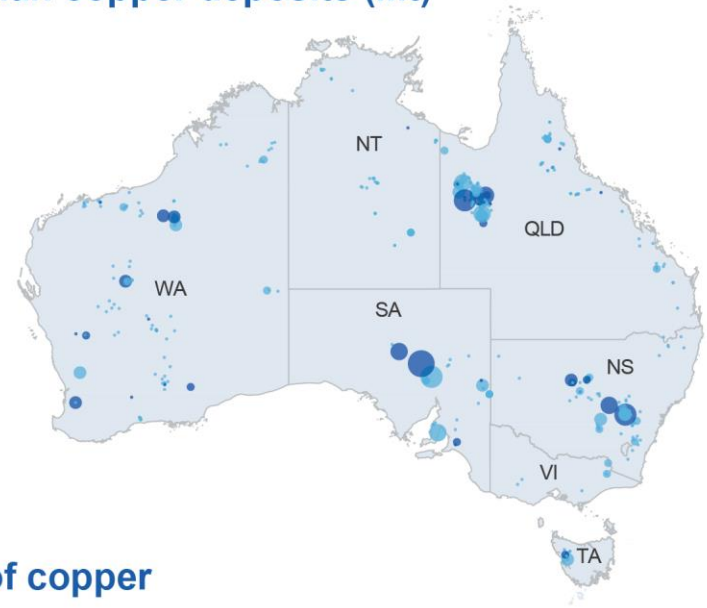
Australia is the **7th largest** producer of copper in the world

Copper is **100% recyclable** and nearly **80%** of the copper that has ever been produced is still in use today

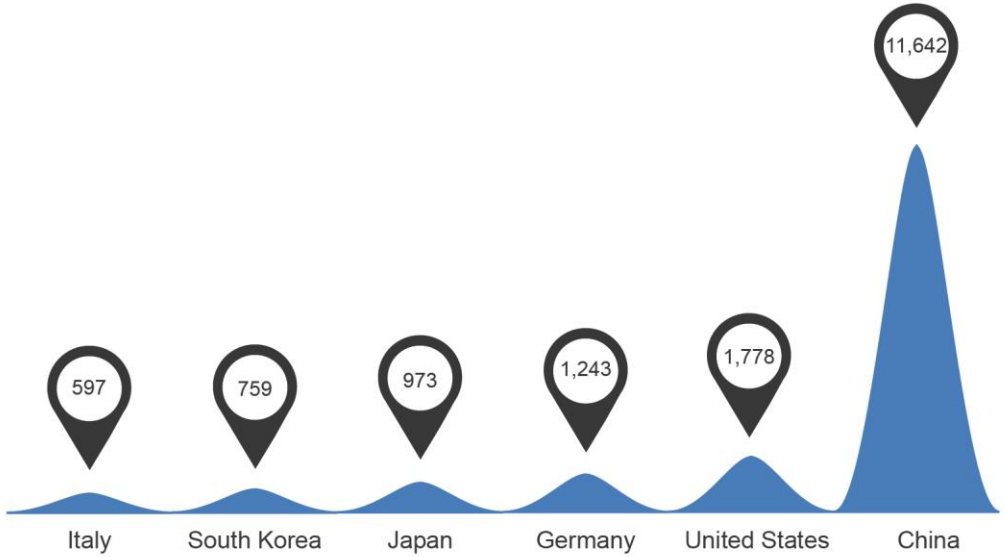
The average home contains **180 kg** of copper

Major Australian copper deposits (Mt)

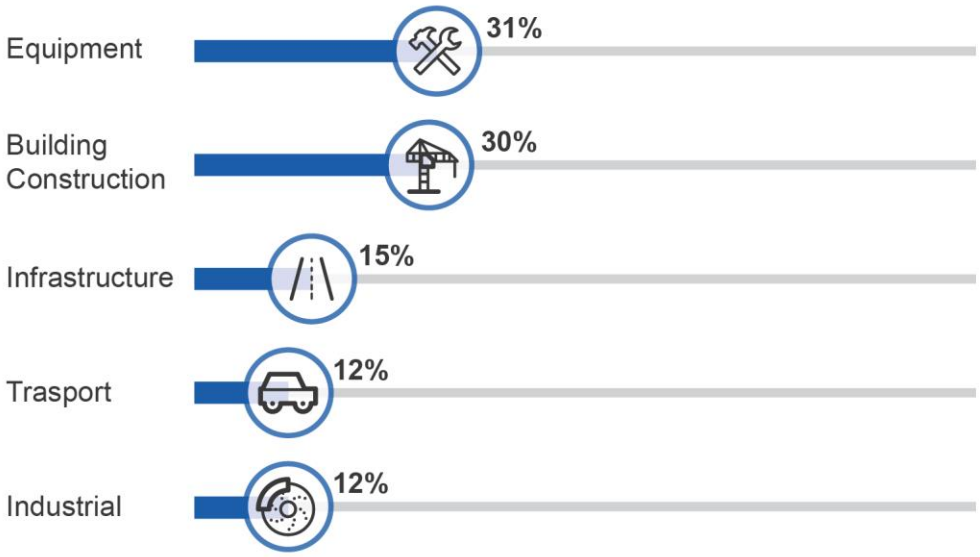
- <0.01
- 0.02
- 0.03–0.8
- 0.9–2.1
- 2.2–6.8
- >6.9
- Deposit
- Operating mine



Key copper consumer markets (thousand tonnes)



Global uses of copper



12.1 Summary

- World prices are expected to average US$6,340 a tonne in 2018 and US$6,490 a tonne in 2019, driven by steady demand from China and global industrial production.
- The value of Australia's copper exports is forecast to increase from $7.5 billion in 2016–17 to $8.7 billion by 2018–19. Growth in export earnings will be supported by higher export volumes and higher copper prices.
- Australia's copper exports are forecast to rise from 921,000 tonnes in 2016–17 to 994,000 tonnes in 2018–19, supported by new mines and expansion projects over 2018 and 2019.

12.2 Prices

Copper prices reach a three year high in December quarter

The London Metal Exchange (LME) copper price is estimated to have averaged US$6,810 a tonne in the December quarter, the highest level since September quarter 2014. The copper price was propelled higher by strong growth in global industrial production and several supply disruptions, including incidents at KGHM's Glogow smelter in Poland and Rio Tinto's Garfield operations in the US.

Copper inventories on the major global exchanges fell by 6.4 per cent quarter on quarter, which contributed to higher prices in the December quarter.

Copper prices expected to taper in 2018

The LME copper price is forecast to average US$6,340 a tonne in 2018, (falling from December quarter 2017) driven by supply surpluses. Then, the copper price is forecast to rise to US$6,490 a tonne in 2019, as consumption outpaces supply.

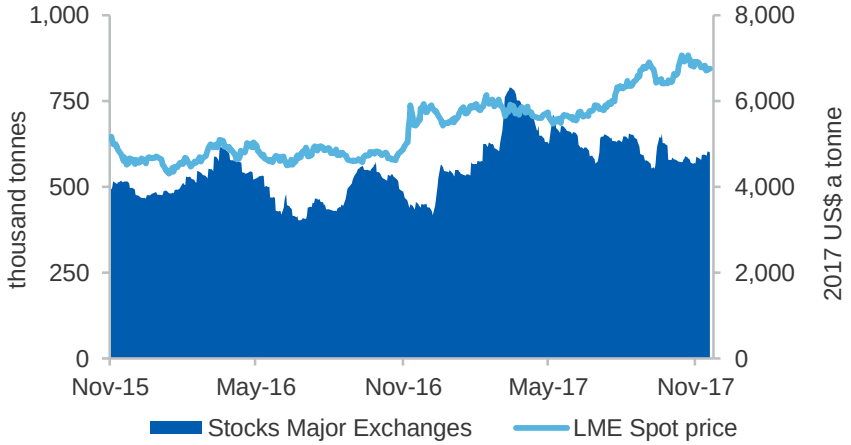
2017 was marked by a number of unexpected supply disruptions, including an industrial dispute at BHP's Escondida — where negotiations are expected to resume in mid-2018 under new Chilean labour laws — raising the possibility of further strike action next year.

Chinese demand for copper is expected to moderate in 2018 and 2019, and is a key risk to forecast copper consumption and hence prices.

The global copper market is expected to be roughly balanced in 2018, with a market surplus of 17,000 tonnes. Copper inventory — in terms of the number of weeks of consumption — is forecast to remain steady at around 2.3 weeks in 2017 and in 2018. In 2019, consumption growth is expected to outpace growth in mine supply, resulting in a market deficit of 79,000 tonnes, with stock levels falling back to 2.1 weeks of consumption.

In a market of over 23 million tonnes, projections of a roughly balanced market in 2018 and a minor deficit in 2019 suggest that the copper price is more than usually prone to problems on the supply side. So the risks to price are heavily skewed to the upside over the outlook period.

Figure 12.1: Copper prices and stocks on major exchanges



Source: LME (2017) official cash price; Bloomberg (2017) stock inventory at LME, COMEX and SHFE

12.3 World consumption

Copper consumption rises in September quarter 2017

World refined copper consumption increased by 2.6 per cent year-on-year in the September quarter 2017 to 5.9 million tonnes. Consumption was supported by higher usage growth in China and Europe, where demand increased by 8.8 per cent and 10 per cent, respectively. China's industrial production grew by 6.6 per cent, contributing to higher copper demand. European industrial production increased by 3.5 per cent in the year to the September quarter. The European Purchasing Manufacturers Index (PMI) increased continually over the four months to November, pointing to further industrial growth over the near term, which should support higher copper consumption in Europe into early 2018.

Consumption outlook improves

Global copper consumption is forecast to rise from 24 million tonnes in 2017 to 25 million tonnes in 2019, representing an average increase of 3.2 per cent each year. Higher copper consumption will be supported by firm growth in global industrial production and higher investment in energy infrastructure. Emerging economies are expected to drive much of the growth in copper consumption over the next two years.

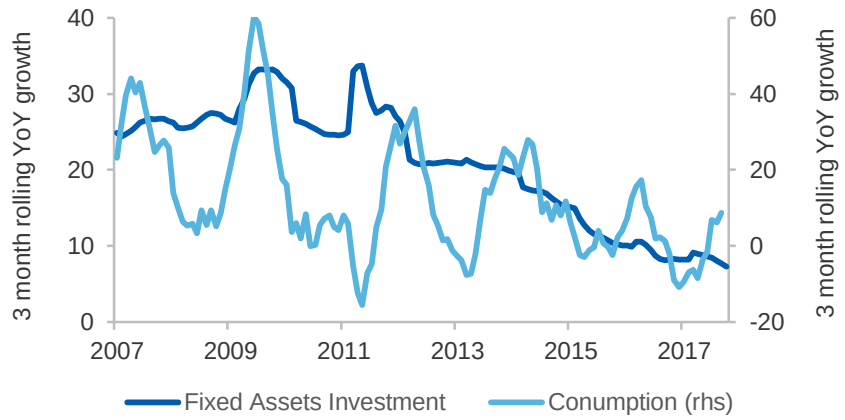
China's copper consumption — which accounts for 50 per cent of global demand — is expected to increase over the outlook period, driven by investment in the nation's power grid and firm growth in the construction and manufacturing sectors. Expenditure on China's power grid increased by 4.0 per cent year-on-year in the three months to October. In an effort to keep up with growing consumer demand for energy, China is expected to invest further in expanding the power grid, albeit at a more moderate pace over the outlook.

China's investment in fixed assets increased by 7.3 per cent year-on-year over the three months to October 2017. While this growth remains high by world standards, growth in fixed asset investment has been in steady decline since 2011, and is expected to moderate further over the outlook period, tapering the outlook for copper usage.

Growing demand for electric cars and renewable energy globally will lead to stronger growth in copper consumption over the next two years. Increased global production of electric vehicles — which contain on average 85 kilograms of copper, compared to 25 kilograms for regular vehicles — is expected to raise copper consumption by around 300,000 tonnes annually in 2018 and 2019.

Copper is used extensively in renewable energy technology and infrastructure, spending on which is expected to increase strongly over the outlook period. Global electricity capacity from renewable sources is expected to increase by 4.4 per cent annually over the outlook period.

Figure 12.2: Chinese copper consumption and Fixed Assets Investment



Source: World Bureau of Metal Statistics (2017); National Bureau of Statistics China (2017); Department of Industry, Innovation and Science (2017)

12.4 World production

World copper mine production likely rose modestly in 2017

World mine copper production increased by 1.4 per cent year-on-year in the September quarter of 2017 to 5.3 million tonnes. The rise in production was led by increased supply from Chile — the world's largest producer. Production at Escondida — Chile's largest copper mine — increased by 14 per cent year-on-year in the September quarter, supported by a recent mine expansion and higher copper grades. Copper production in China, Peru and Kazakhstan also grew strongly, while Indonesia and the USA had the largest declines year-on-year.

World mine production expected to rise

Global copper mine production is forecast to rise from 20 million tonnes in 2017 to 22 million tonnes by 2019, representing an average increase of 4.3 per cent per year. Growth in world mine supply will be driven by new mines and expansions across most of the major producing nations.

Mine production is expected to rise by 4.8 per cent in 2018, with 780,000 tonnes of extra capacity from committed new projects and a further 290,000 tonnes from mine expansions. Cobre Panama, operated by First Quantum Minerals, is expected to make the largest contribution to new mine supply, with an estimated annual capacity of 330,000 tonnes. The new Qulong copper mine — currently under development — operated by Tibet Julong Mining, is expected to add a further 120,000 tonnes. The two largest expansion projects — Codelco's Radomiro in Chile and Southern Copper's Toquepala in Peru — are expected to each contribute an additional 100,000 tonnes in 2018.

Mine expansions are expected to increase production capacity by a further 255,000 tonnes in 2019. The largest expansion project — Chinalco's Toromocho copper mine in Peru — is expected to increase production by a further 100,000 tonnes in 2019.

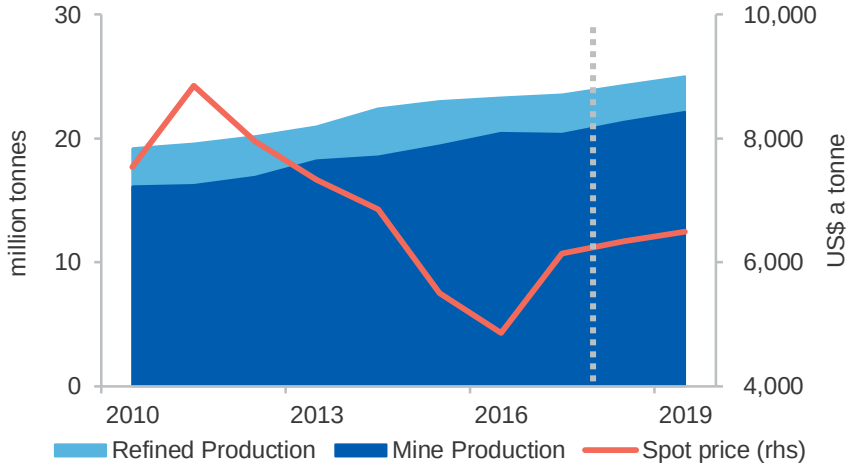
World refined copper production near historical high in September

World refined copper production increased by 1.0 per cent year-on-year in the September quarter 2017, to 6.0 million tonnes — the second highest quarterly production on record. Higher production was led by Europe and China, which increased production by 130,000 and 55,000 tonnes year-on-year in the September quarter, respectively.

World refined copper output expected to rise over the outlook

Global refined copper production is forecast to rise from 24 million tonnes in 2017 to 25 million tonnes by 2019, representing an average increase of 3.1 per cent each year. Higher refined production will be driven by new refineries and expansion projects in China, where production capacity is expected to increase by 840,000 tonnes in 2018 and a further 525,000 tonnes in 2019. Secondary production — which declined 1.4 per cent year-on-year in September 2017 — is expected to increase over the outlook, driven by higher copper prices and higher availability.

Figure 12.3: World copper production and prices



Source: World Bureau of Metal Statistics (2017); Department of Industry, Innovation and Science (2017)

12.5 Australia's production and exports

Production declines in the September quarter

Australia's mine production declined by 3.0 per cent year-on-year in the September quarter, weighed down by smelter maintenance at Glencore's Mount Isa operations and reduced output at Newcrest's Cadia Valley mine — which fell by 35 per cent year-on-year in the September quarter, as the mine continued to recover from seismic activity earlier in the year.

Improved outlook for mine production

Australian production is forecast to increase by 5.7 per cent annually, from 916,000 tonnes in 2016–17 to 1,023,000 tonnes by 2018–19.

Higher Australian production will be driven by increased output at BHP's Olympic Dam — Australia's largest copper mine — which is expected to produce 215,000 tonnes in 2018–19 after expansion works are completed. The Capricorn copper mine in Queensland, successfully produced its first copper concentrate in the December quarter, and is expected to add a further 30,000 tonnes to annual production capacity over the outlook period.

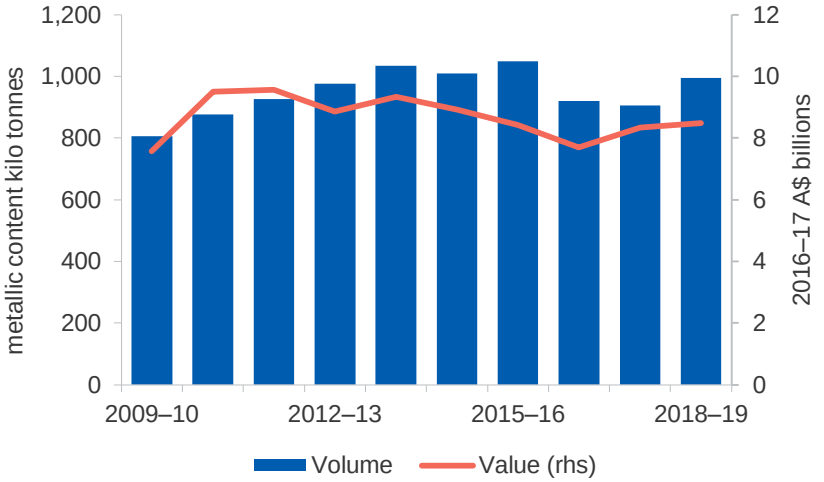
Copper exports set to increase over the outlook

Australia's copper export earnings decreased by 3.5 per cent year-on-year in the September quarter to $1.7 billion. Lower earnings were weighed down by lower export volumes, which more than offset the impact of higher world prices. Exports of refined copper to China declined by 39 per cent year-on-year in the September quarter, however, exports of copper ores and concentrates increased by 29 per cent over the same period — symptomatic of China's growing refinery capacity and Australia's rising refinery costs, as electricity prices increase.

The value of Australia's copper export earnings is forecast to increase from $7.5 billion in 2016–17 to $8.6 billion in 2018–19. Australia's copper exports (in metal-content terms) are forecast to increase by 4.5 per cent annually, from 921,000 tonnes in 2016–17 to 994,000 tonnes in 2018–19.

Australia's export earnings from copper will be supported by new projects and mine expansions.

Figure 12.4: Australia's copper exports



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

Exploration expenditure improves

Australia's copper exploration expenditure increased by 28 per cent year-on-year in the September quarter 2017 to $45 million. This was the third consecutive quarterly increase in exploration expenditure, reflecting an improved outlook for copper prices.

Higher exploration expenditure in the September quarter was led by Queensland and Western Australia, where spending increased by 46 per cent and 13 per cent, respectively. Expenditure is expected to rise over the next two years, as higher prices encourage new exploration.

Table 12.1: Copper Outlook

						Annual percentage change		
World	**Unit**	**2016**	**2017 s**	**2018 f**	**2019 f**	**2017 e**	**2018 f**	**2019 f**
Production								
mine	kt	20,451	20,379	21,349	22,149	-0.4	4.8	3.7
refined	kt	23,310	23,557	24,313	25,023	1.1	3.2	2.9
Consumption	kt	23,412	23,589	24,296	25,102	0.8	3.0	3.3
Closing stocks	kt	1 095	1 063	1 080	1 002	-2.9	1.6	-7.3
weeks of consumption		2.4	2.3	2.3	2.1	-3.7	-1.3	-10.3
Price LME								
nominal	US$/t	4,863	6,144	6,340	6,490	26.4	3.2	2.4
	US$/lb	221	279	288	294	26.4	3.2	2.4
real b	US$/t	4,965	6,144	6,208	6,218	23.7	1.0	0.2
	US$/lb	225	279	282	282	23.7	1.0	0.2
Australia	**Unit**	**2015–16**	**2016–17 s**	**2017–18 f**	**2018–19 f**	**2016–17 e**	**2017–18 f**	**2018–19 f**
Mine production	kt	990	916	950	1,023	-7.4	3.6	7.8
Refined production	kt	514	448	455	478	-12.9	1.6	5.2
Export Volume								
ores and cons. c	kt	1,870	1,754	1,692	1,959	-6.2	-3.5	15.8
refined	kt	507	413	407	431	-18.5	-1.6	6.1
total metallic content	kt	1 050	921	905	994	-12.3	-1.7	9.8
Export value								
nominal	A$m	8,110	7,540	8,346	8,680	-7.0	10.7	4.0
real d	A$m	8,419	7,695	8,346	8,478	-8.6	8.5	1.6

Notes: **b** In 2017 calendar year US dollars; **c** Quantities refer to gross weight of all ores and concentrate s; **d** In 2017–18 financial year Australian dollars; **f** Forecast; **s** Estimate
Source: ABS (2017) International Trade, 5465.0; LME (2017) spot price; World Bureau of Metal Statistics (2017) World Metal Statistics; Department of Industry, Innovation and Science (2017)

Nickel

Resources and Energy Quarterly December 2017

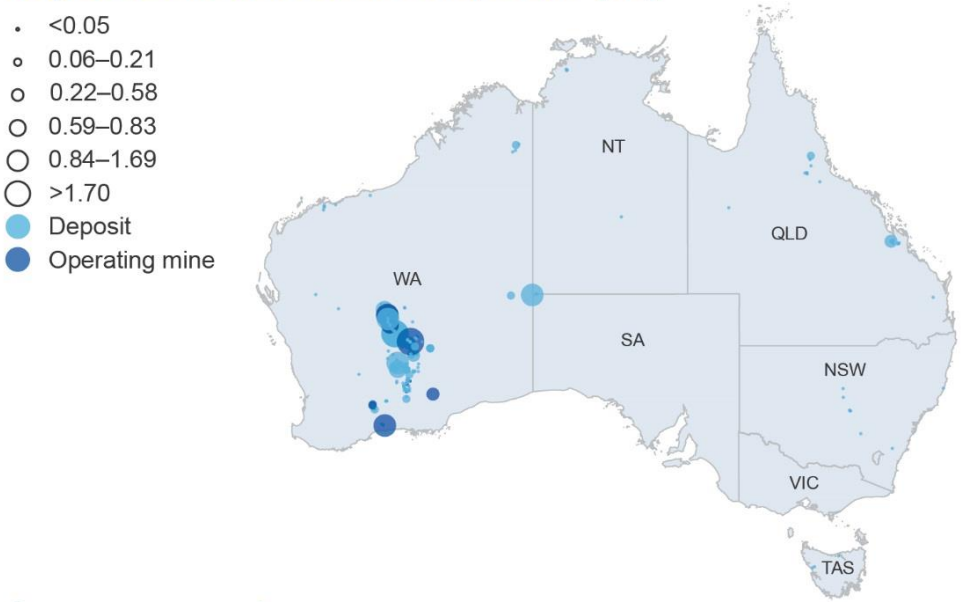
5th largest miner in the world

Australia produces **>200** thousand tonnes of nickel each year

Nickel exports contribute more than **$2b** to Australia's economy

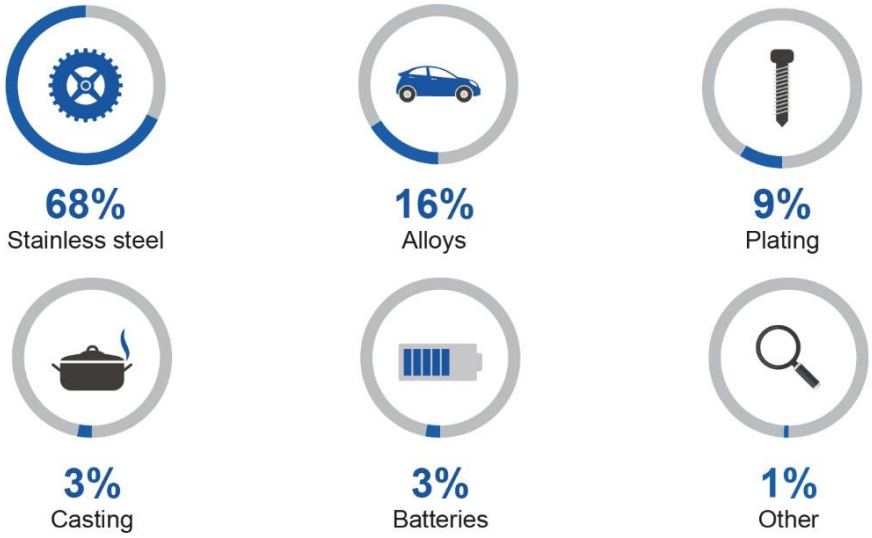
10% of world nickel mined is in Australia

Major Australian nickel deposits (Mt)



Key nickel consumer markets (tonnes)

Global uses of nickel



13.1 Summary

- Global market conditions for nickel are strong, supported in the short-term by higher stainless steel production, and in the long-term by higher lithium-ion battery production.
- Australian mine production is expected to fall to 176,000 tonnes in 2017–18 before recovering slightly to 183,000 tonnes in 2018–19.
- Australia's nickel export earnings are forecast to fall slightly to $2.1 billion in 2017–18, before rebounding to $2.3 billion in 2018–19.

13.2 Prices and stocks

Nickel prices are still growing from a low point in mid-2017

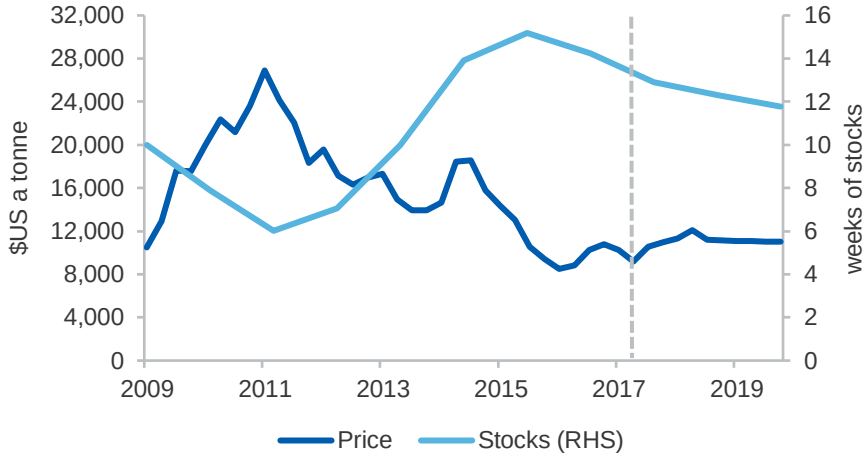
Nickel prices rose to $US10,538 a tonne in the September quarter and are forecast to average $US10,946 in the December quarter, with demand pressure pulling prices up until new supply enters the market. Prices are expected to lift from $US10,200 a tonne in 2017 to just over $US11,400 a tonne in 2018, before falling marginally in 2019.

Nickel prices have been lifted recently, as markets factor in growing demand linked to lithium-ion batteries, which include substantial amounts of nickel sulphate in their composition. It is not clear, however, that the immediate boost to prices will persist. Although sales of electric vehicles are rising sharply, at this stage, batteries still account for a small share of nickel sales, and stainless steel is still estimated to account for around two-thirds of nickel consumption over the outlook period.

Some short-term price pressure is also expected following an announcement by Vale mining that nickel output will be cut by more than 30,000 tonnes in 2018. Nickel prices rose by 2.6 per cent immediately following the announcement, though it is not yet clear whether the full set of cuts will ultimately be implemented. The company is seeking "optionality" rather than structural cuts, suggesting that production curbs may be lifted should prices continue to rise.

The outlook for nickel prices is thus relatively solid, supported in the short term by production cuts and stainless steel production, and in the longer term by battery production, which should accelerate from the early 2020s.

Figure 13.1: Nickel LME spot prices and stocks



Source: Bloomberg (2017) London Metal Exchange; International Nickel Study Group (2017); Department of Industry, Innovation and Science (2017)

13.3 World consumption

Rising stainless steel and battery output is driving nickel usage

World nickel consumption rose by 5.4 per cent year-on-year in the September quarter. This rise was driven primarily by higher output of stainless steel in China, with a small and growing contribution from battery sales in the US and EU. It is expected that growth in stainless steel output will slow slightly over the outlook period, though China and Indonesia (which are ramping up capacity) are expected to continue expanding. Global nickel consumption is forecast to grow by 4.9 per cent (to 2,259 kt) in 2018, and by a further 4.5 per cent (to 2,359 kt) in 2019.

The combination of high stainless steel demand and rising battery demand suggests a solid outlook for nickel over the outlook period and beyond.

13.4 World production

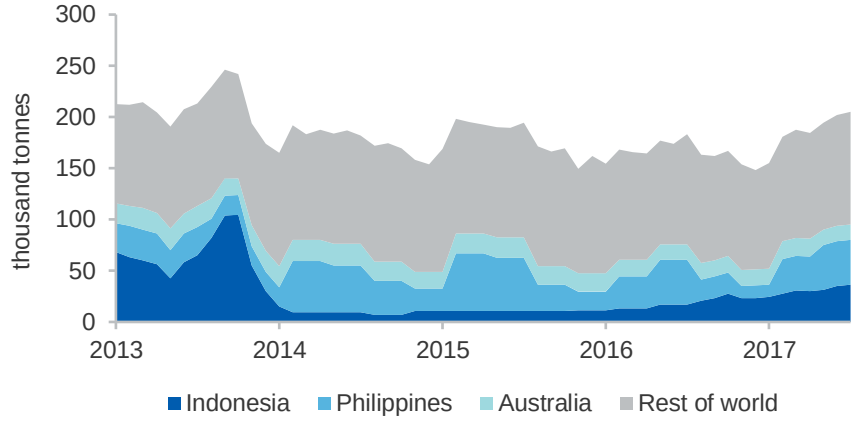
Production is rising as governments seek to remove constraints

World mined nickel production is growing strongly at present, rising by 12.5 per cent through the year to the September quarter. A total of 602 kt of nickel was mined in the quarter — the highest output since 2014.

This output growth has been supported, in part, by higher mine activity and, in part, by the relaxation of environmental and export restrictions in several countries. There are a range of signs suggesting supply may lift further over the outlook period. A temporary ban on open-pit mining in the Philippines may soon be reversed, and the Indonesian Government has hinted at plans to further relax its partial ban on exports of nickel ore.

Several new mines are also expected to come online around the world over the next few years. As a result, global mine output is expected to reach 2,278 kt in 2018 and 2,379 kt in 2018.

Figure 13.2: World mined nickel production, monthly



Source: International Nickel Study Group (2017)

13.5 Australia's exploration, production and exports

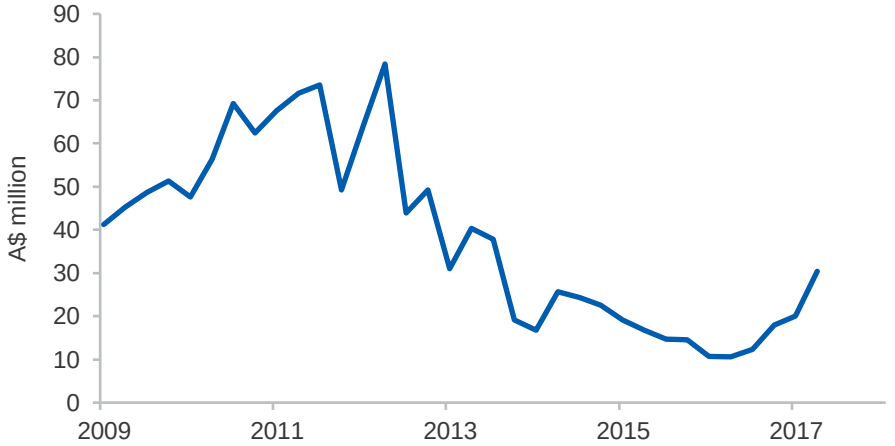
Exploration expenditure continued to rise in the September quarter

Fuelled by rising prices, nickel and cobalt exploration expenditure more than tripled year-on-year, to reach $39.7 million in the September quarter. Around two thirds of this expenditure was in Western Australia, where substantial nickel deposits remain untapped.

Australian production is falling, due to a series of mine closures

Australian nickel production is expected to remain constrained, despite the more positive price outlook in recent months. Mined production fell by 17 per cent year-on-year, reaching 41,000 tonnes in the September quarter. However, refined production picked up by 9 per cent year-on-year, to reach 29,000 tonnes in the quarter.

Figure 13.3: Australia's nickel and cobalt exploration expenditure, quarterly



Source: ABS (2017) Mineral and Petroleum Exploration 8412.0

A series of mine and facility closures have hampered mined and refined production in Australia, with the latest closure being First Quantum's substantial Ravensthorpe mine (which was placed on 'care and maintenance' in October). This mine previously accounted for more than 20 per cent of all Australian mined output, and its closure is expected to reduce mine output considerably from the September quarter.

Other mines have faced minor disruption due to maintenance, with operations owned by Western Area (including the Forrestania deposit) expected to reduce concentrate production by around 250 tonnes over the second half of 2017 before returning to normal by year's end.

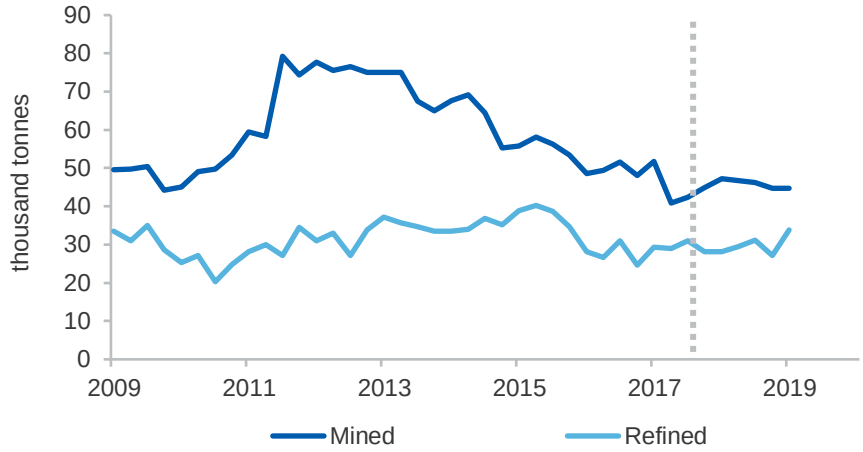
BHP recently announced an investment of $55 million on its stage one upgrade of the Kwinana nickel sulphate plant in Western Australia. This will expand nameplate capacity for the facility to around 100,000 tonnes a year from early 2019, making it the world's biggest producer of nickel sulphate. The company is also planning to accelerate stage two upgrades, which would lift output again to 200,000 tonnes per annum. The investment is being made in response to rising global interest in lithium-ion batteries, which contain high concentrations of nickel sulphate.

Export earnings are expected to bottom out in 2017–18

Australia's nickel export earnings lost ground in the September quarter, with provisional estimates suggesting a fall from $552 million a year ago to $387 million. The result was unusually low and reflects a range of previously noted mine closures as well as delays in shipping. Exports fell by 18 per cent to $2,197 million in 2016–17 as a result of falls in both refinery and mine output, and particularly sharp declines in ores and concentrate exports.

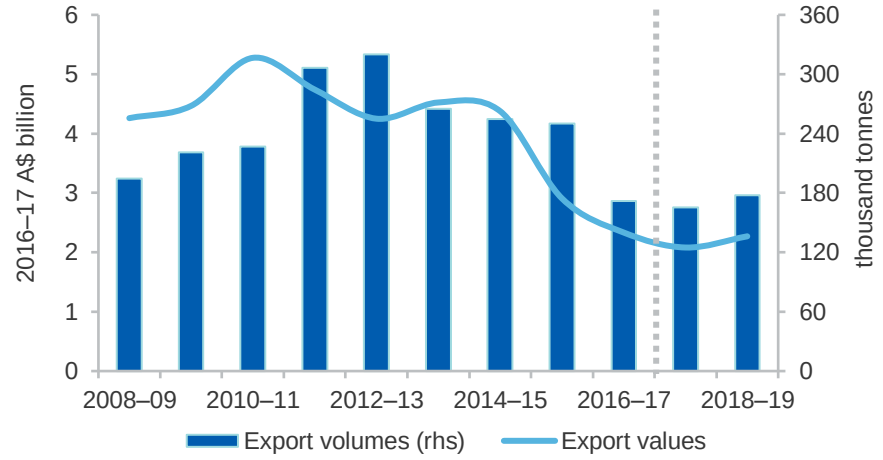
Export values are forecast to decline to $2,081 million in 2017–18, due to the closure of Ravensthorpe and falls in production at other mines. However, some recovery is expected in 2018–19, with export values expected to rise to $2,272 million. This reflects the likelihood of higher production at Independence Group's Nova mine and greater output at BHP's Kwinana facility following the completion of its stage one upgrade.

Figure 13.4: Australia's nickel production



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

Figure 13.5: Australia's nickel export volumes and values



Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Table 13.1: Nickel outlook

World	Unit	2016	2017 f	2018 f	2019 f	Annual percentage change 2017 f	2018 f	2019 f
Production								
– mine	kt	1,990	2,150	2,278	2,379	8.0	5.9	4.4
– refined	kt	1,984	2,142	2,269	2,369	8.0	5.9	4.4
Consumption	kt	2,033	2,153	2,259	2,359	5.9	4.9	4.4
Stocks	kt	555	533	533	533	-4.0	0.0	0.0
– weeks of consumption		14.2	12.9	12.3	11.7	-9.3	-4.7	-4.3
Price LME								
– nominal	US$/t	9,599	10,245	11,438	11,053	6.7	10.9	-2.7
	Usc/lb	435	465	519	501	6.7	10.9	-2.7
– real b	US$/t	9,801	10,245	11,199	10,590	4.5	8.6	-4.8
	Usc/lb	445	465	508	480	4.5	8.6	-4.8
Australia	**Unit**	**2015–16**	**2016–17 s**	**2017–18 f**	**2018–19 f**	**2016–17 s**	**2017–18 f**	**2018–19 f**
Production								
– mine cs	kt	216	201	176	183	-7.2	-12.6	4.0
– refined	kt	142	112	116	122	-21.2	4.0	4.5
– intermediate	kt	44	37	25	16	-15.9	-33.1	-35.3
Export volume ds	kt	250	175	165	178	-30.0	-5.7	7.5
– nominal value s	A$m	2,935	2,199	2,081	2,270	-25.1	-5.3	9.1
– real value es	A$m	3,046	2,244	2,081	2,217	-26.4	-7.2	6.6

Notes: **b** In 2017 calendar year US dollars; **c** Nickel content of domestic mine production; **d** Includes metal content of ores and concentrates, intermediate products and nickel metal; **e** In 2017–18 financial year Australian dollars; **f** Forecast, **s** Estimate, **z** Projection

Source: ABS (2017) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Innovation and Science; International Nickel Study Group (2017); LME (2017); World Bureau of Metal Statistics (2017)

Zinc

Resources and Energy Quarterly December 2017

Australia produces more than
800,000 tonnes
of zinc each year

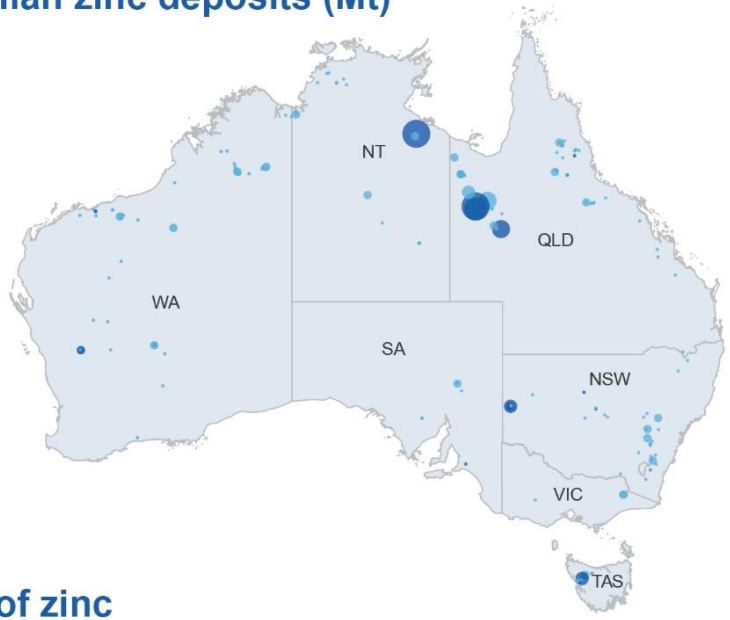
Zinc exports contribute more than
$2.5 billion
to the Australian economy

Australia is the
3rd highest
producer of zinc in the world

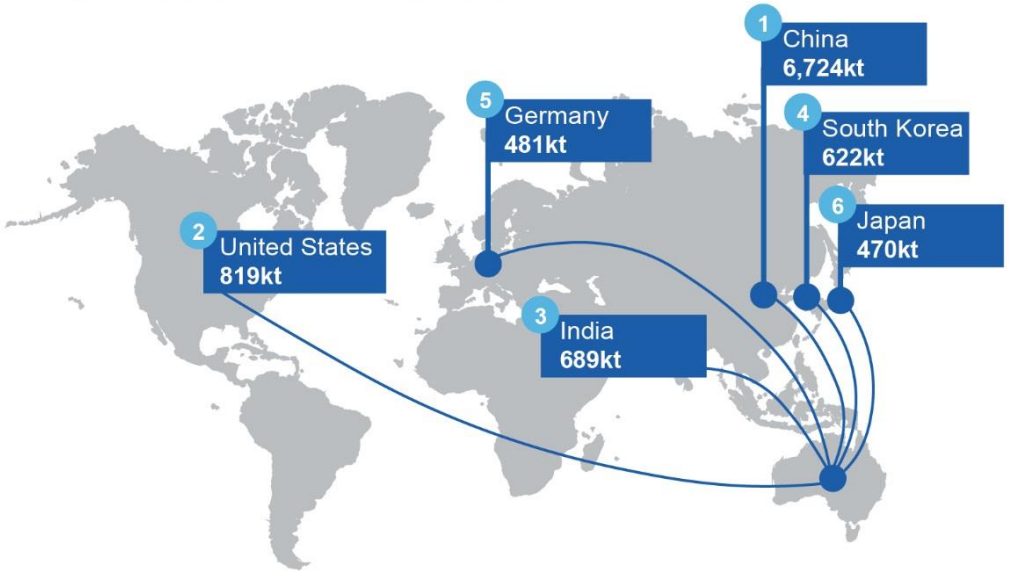
Australia holds
20%
of the worlds known zinc resources

Major Australian zinc deposits (Mt)

- <0.01
- 0.02–0.03
- 0.04–0.09
- 0.10–0.20
- 0.21–0.44
- >0.45
- Deposit
- Operating mine



Key zinc consumer markets



Global uses of zinc

50%
galvanise steel

17%
diecasting

17%
make brass and bronze alloys

6%
rolled zinc

6%
chemicals

4%
other

14.1 Summary

- High prices are expected to drive a rise in mine supply during 2018, but the outlook for refined supply is somewhat less clear.
- Rising prices are expected to boost Australia's export earnings by 11 per cent to $3.0 billion in 2017–18. Production growth is forecast to push earnings up 4 per cent to $3.1 billion in 2018–19.

14.2 Prices and stocks

Zinc prices have lifted strongly due to supply constraints

The LME zinc price is estimated to have averaged $US2,860 a tonne in 2017 — 37 per cent higher than in 2016. The zinc price rose steadily during the September and December quarters, peaking at over $US3,300 a tonne at the start of November.

Price forecasts have been revised up from the September 2017 *Resources and Energy Quarterly,* as industrial action at a key Canadian refinery has reduced refined supply. Prices are now forecast to average $US2,990 a tonne over 2018, remaining above $US3,000 a tonne for the first half of 2018 before easing back in the second half. Additional supply is forecast to bring prices down to around $US2,840 a tonne over 2019.

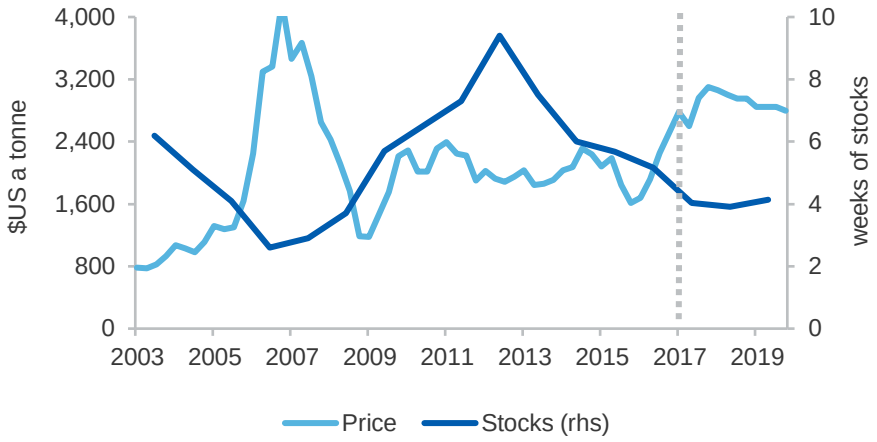
Stocks are forecast to edge up as prices and supply pressures ease off, slightly towards the end of the outlook period.

14.3 World consumption

Consumption growth is steady in Asia, but unpredictable in the US

World refined zinc consumption is forecast to rise by 3.5 per cent to 14.9 million tonnes in 2018, and by a further 3.6 per cent to 15.4 million tonnes in 2019. Zinc demand is expected to be supported by increased global car sales, rising world industrial production, and increased rail and infrastructure investment across Asia.

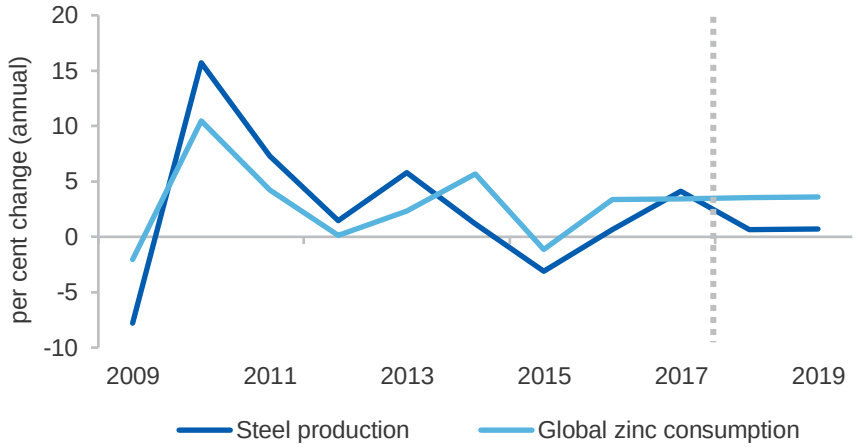
Figure 14.1: Zinc prices and stocks



Note: Zinc spot price

Source: London Metal Exchange (2017)

Figure 14.2: Annual change in global steelmaking and zinc use



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

Infrastructure spending remains the key "swing factor" in zinc demand. Chinese infrastructure spending faces downside risks, as a result of surging debt among local governments, who typically supply most of the funding. Pressure to build infrastructure in China may also ease following the end of the 19th Party Congress and the commencement of a new five-year political cycle. The prospects for the planned upgrade of US infrastructure are also unclear, with no timetable or budget in place yet.

14.4 World production

World mined production is expected to pick up in 2018

Miners have responded to high prices and rising demand by developing a range of new deposits, with substantial additional supply expected in 2018. Among these sources are Vedanta's Gamsberg mine in South Africa, which is expected to add 60,000 tonnes of production in 2018. Output from this mine is subsequently expected to scale up, eventually reaching 250,000 tonnes per year. Trafigura's Castellanos project in Cuba (which was carried out in partnership with the Cuban Government) is expected to add around 50,000 tonnes of global supply in 2018, with supply ultimately scaling up to 100,000 tonnes per year. Several smaller Chinese projects are also expected to increase their output over 2018 and 2019.

This new mine supply is expected to lift total mined output by 5.5 per cent to 14.2 million tonnes in 2018, with a further rise of 2.6 per cent (to 14.5 million tonnes) forecast for 2019.

Refined production is expected to rise, but at a slower pace

Refined zinc supply has risen over the past few years, as Asian smelters have expanded their output. However, a notable bottleneck remains. Output at the Noranda Income Fund's CEZ plant in Quebec — which is among the largest producers of refined metal in the world — fell by almost half during 2017, as a result of industrial action. A conclusion to the dispute will likely add more than 120,000 tonnes of refining capacity. Government mediation is underway, but it remains unclear when an agreement can be struck, and thus when full production to resume.

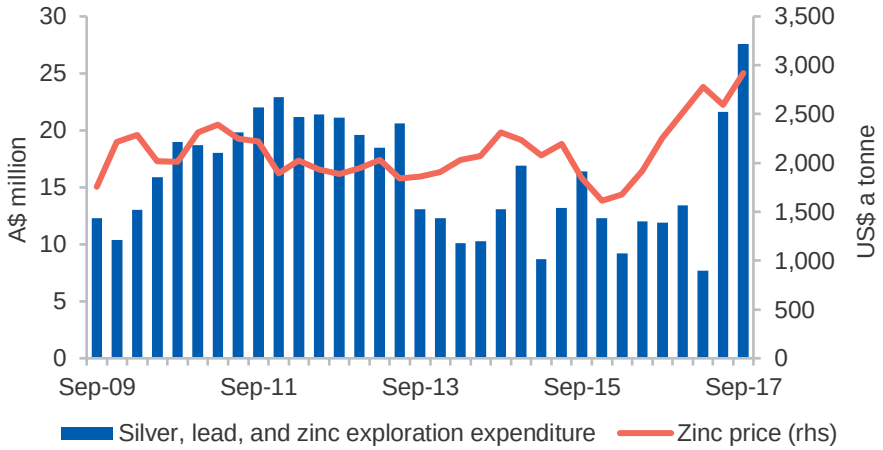
It is expected that refined production will rise by 5.4 per cent to 14.9 million tonnes in 2018. A further rise of 2.9 per cent (to 15.3 million tonnes) is forecast for 2019. However, the existence of constraints at both the mine and refining stages of zinc supply will complicate efforts to bring supply into line with global zinc demand.

14.5 Australia's exploration, production and exports

Higher prices have led to a strong rebound in exploration expenditure

Australia's expenditure on zinc, lead and silver exploration rose to $28 million during the September quarter — more than double the level of a year ago. The bulk of exploration occurred in northern Australia, where zinc deposits are concentrated.

Figure 14.3: Australia's silver, lead and zinc exploration expenditure



Source: ABS (2017) Mineral and Petroleum Exploration, cat. no. 8412.0; LME (2017)

Australian mined production is starting to recover

Australian mined output has been constrained since the closure of MMG's Century mine in 2015. However, the recent zinc price surge has accelerated efforts to bring new capacity online. Among the new supply sources is MMG's Dugald River mine, which produced its first shipment of concentrate in November. This mine is expected to produce around 80,000 tonnes of output in 2017–18, eventually doubling from this level to become one of the largest zinc mines in the world.

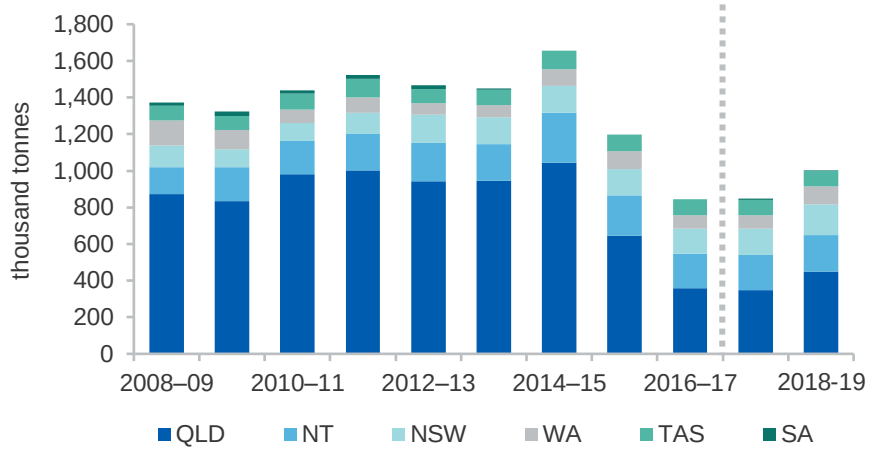
Other mines moving towards production in 2018–19 include KBL's Sorby Hills mine and Heron Resources' Woodlawn mine, with Independence Group's Stockman operation expected to come online towards the end of the outlook period. Surging prices have even led to the possibility of a re-opening of the Century mine, which still retains significant zinc deposits in its tailings. Glencore has announced a re-opening of its Lady Loretta mine, and a restart of its McArthur River mine is also possible. However, the company has revised down zinc production targets for other mines.

Australia's refined production is forecast to remain largely unchanged over the outlook period, with no significant disruptions expected at Sun Metal's Townsville smelter or Nyrstar's Hobart smelter. A shift from 30 minute to five minute settlements within the National Electricity Market is likely to help contain power prices, enabling both smelters to operate near capacity.

Zinc exports are expected to grow in line with rising production

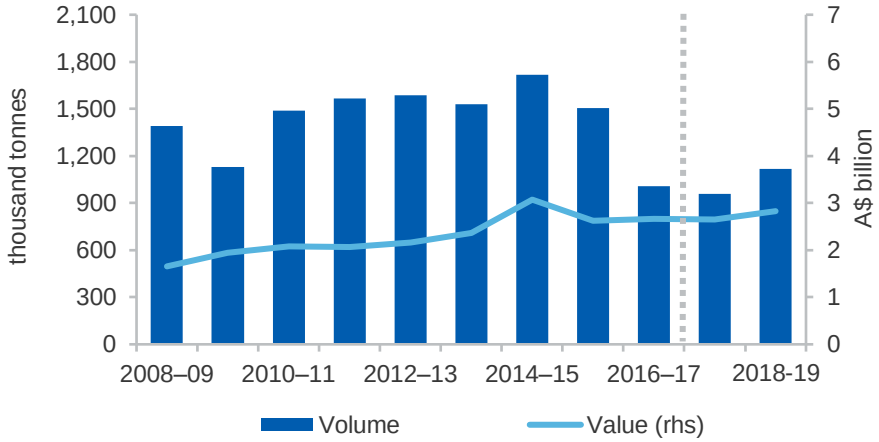
Higher mine production is expected to feed through to increase export volumes, with Australia's exports of metallic content forecast to rise by 1.9 per cent in 2017–18, and then by 18 per cent in 2018–19. Export earnings are also forecast to rise. Earnings are expected to grow by 11 per cent in 2017–18, propelled by higher prices. Prices are subsequently expected to fall, but higher export volumes should to lift export earnings by 4.4 per cent in 2018–19. Rail and infrastructure development and automotive sales across Asia will continue to create strong opportunities for Australian exporters, with capacity likely to remain the primary constraint.

Figure 14.4: Australia's zinc production by state



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

Figure 14.5: Australia's zinc exports



Source: ABS (2017) International Trade in Goods and Services, cat. No. 5368.0, Department of Industry, Innovation and Science (2017)

Table 14.1 Zinc outlook

World	Unit	2016	2017 f	2018 f	2019 f	Annual percentage change 2017 f	2018 f	2019 f
Production								
– mine	kt	12,838	13,437	14,176	14,546	4.7	5.5	2.6
– refined	kt	14,004	14,128	14,895	15,324	0.9	5.4	2.9
Consumption	kt	13,914	14,389	14,895	15,435	3.4	3.5	3.6
Closing stocks	kt	1,375	1,114	1,114	1,225	-19.0	0.0	10.0
– weeks of consumption		5	4	4	4	-21.7	-3.4	6.1
Price								
– nominal	US$/t	2,092	2,860	2,990	2,838	36.7	4.5	-5.1
	USc/lb	95	130	136	129	36.7	4.5	-5.1
– real b	US$/t	2,136	2,860	2,928	2,719	33.9	2.4	-7.1
	USc/lb	97	130	133	123	33.9	2.4	-7.1
Australia	**Unit**	**2015–16**	**2016–17 s**	**2017–18 f**	**2018–19 f**	**2016–17 s**	**2017–18 f**	**2018–19 f**
Mine output	kt	1,197	843	828	1,040	-29.6	-1.8	25.6
Refined output	kt	459	466	486	500	1.6	4.2	3.0
Export volume								
– ore and conc. c	kt	2,222	1,479	1,600	2,095	-33.4	8.1	31.0
– refined	kt	497	372	351	327	-25.1	-5.8	-6.9
– total metallic content	kt	1,507	1,008	1,026	1,212	-33.1	1.8	18.2
Export value								
– nominal	A$m	2,628	2,688	2,991	3,118	2.3	11.3	4.2
– real d	A$m	2,728	2,743	2,991	3,045	0.6	9.1	1.8

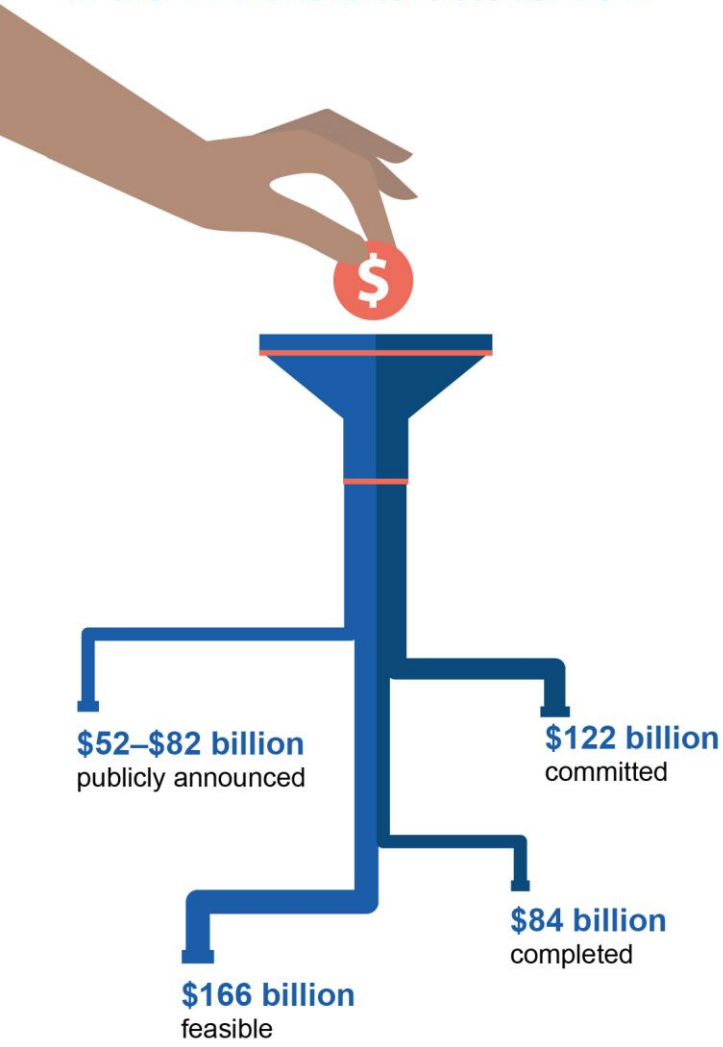
Notes: **b** In 2017 US dollars; **c** Quantities refer to gross weight of all ores and concentrates; **d** In 2017–18 Australian dollars; **f** Forecasts

Source: ABS (2017) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Innovation and Science; International Lead Zinc Study Group (2017); LME (2017); World Bureau of Metal Statistics (2017)

Major Projects

Resources and Energy Quarterly December 2017

Value of resource and energy projects in the investment pipeline in the 12 months to October 2017



Per cent share of value of committed projects by commodity groups

$60 billion Gorgon LNG project
Australia's largest single resource project ever developed

Major projects include over **30 different mineral varieties**

15.1 Overview

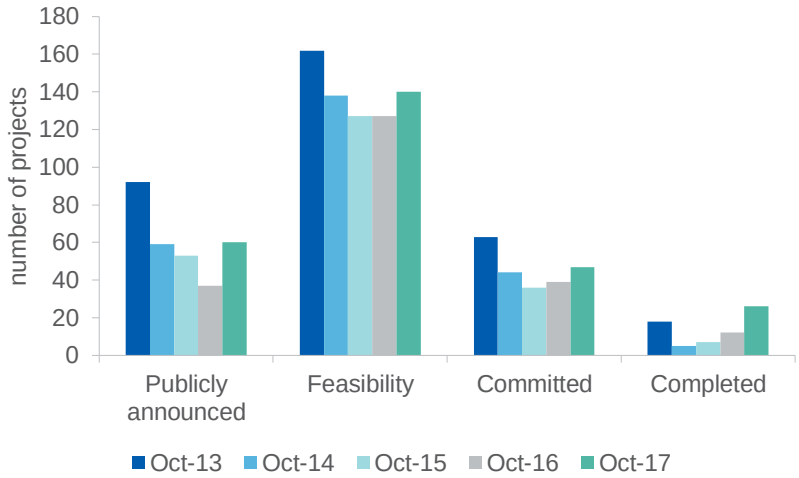
A year on from the release of our last Major Projects publication, the number of committed projects has increased by 5.1 per cent to 41, largely driven by an increase in the number and value of copper, gold, nickel and other minor commodity projects. The value of publicly announced projects as well as projects moving to the feasibility stage have also increased over the past 12 months, in line with higher exploration expenditure and higher resource and energy commodity prices.

While the past few years have been characterised by cutting costs to ensure the commercial viability of existing assets, 2017 has seen some renewed optimism for market conditions and increased producer interest in brownfield expansions and new projects.

As expected the value of 'committed' resource and energy projects has fallen by 17 per cent, new projects where a final investment decision (FID) has been taken will see construction activity commence in the coming months. The decline is largely due to the transition of Gorgon — Australia's largest LNG project and the Roy Hill iron ore project — to the 'completed' stage, while the backlog of projects at the 'feasibility' stage continued to grow.

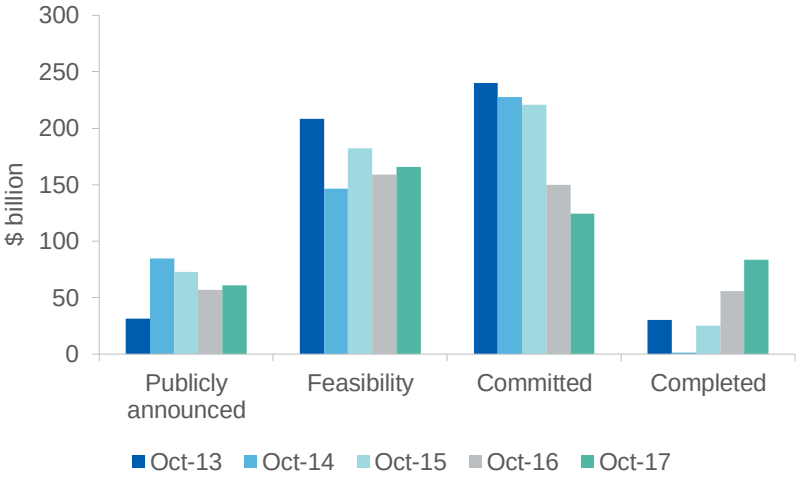
Although the outlook for resource and energy investments is forecast to be relatively subdued with the value of committed projects expected to decline in 2018 and 2019, three mega LNG projects (projects over $5 billion) remain in the investment pipeline at the committed stage. These include Wheatstone, Ichthys and the Prelude Floating LNG project, which are estimated to be worth $100 billion combined. These three projects are expected to be completed by 2018 — largely concluding the current investment phase.

Figure 15.1: Number of projects in the investment pipeline



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

Figure 15.2: Value of projects in the investment pipeline



Notes: value of projects at publicly announced is estimated as the mid-point of the range.
Source: Department of Industry, Innovation and Science (2017)

Table 15.1: Summary of projects in the investment pipeline

	Publicly announced		Feasibility		Committed		Completed	
	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m
Aluminium, Bauxite, Alumina	0	0	0	0	2	1,963	0	0
Coal	14	12,500–20,237+	33	54,787	5	8,693	5	1,569
Copper	3	750–1,747	6	1,376	4	1,991	0	0
Gold	2	0–498	8	2,364	6	1,340	4	448
Infrastructure	7	5,250–9,991	7	7,349	2	1,126	3	4,580
Iron ore	7	5,250–10,493+	16	23,536	3	966	2	11,038
Lead, Zinc, Silver	3	0–747	2	420	3	1,011	1	563
LNG, Gas, Petroleum	7	24,500–27,497+	12	60,749	11	106,167	6	64,965
Nickel	11	3,750–8,989	2	2,960	1	443	0	0
Uranium	2	250–499	4	1,915	0	0	0	0
Other Commodities	1	250–499	35	10,590	4	893	1	800
Total	**57**	**52,500–81,197+**	**125**	**166,046**	**41**	**122,379**	**22**	**83,963**

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

15.2 Introduction

Resources and Energy Major Projects provides a review of the mining, infrastructure projects and processing facilities that increase, extend or improve the output of mineral and energy commodities in Australia. This edition of the report is an update on project developments over the 12 months to October 2017. Its purpose is to measure the value of the current and potential investment in the mining and energy sectors, and to provide an analysis of the key trends and issues underpinning the level of investment. The value of this investment is an important economic indicator for Australia: capital expenditure associated with resources and energy major projects has been a major source of economic activity over the past five years.

The OCE gathers information on major projects from a number of sources, including company websites, Australian Stock Exchange reports, media releases, and from direct contact with company representatives. Although there is substantial investment by mining and energy companies in replenishing equipment, plant and other property, the focus of this report is on 'major' investments — those over $50 million. Smaller scale operations are also an important contributor to the sector and the broader Australian economy. However gathering data on such projects is challenging, as many are undertaken by private companies which have fewer obligations to report progress.

Developers of resources and energy projects often use different planning processes and assessment methods to support an FID. Thus, there is no standard project development model with clearly defined stages and terminology that can be applied to every resources and energy project.

To broadly represent the general lifecycle of a project, OCE use a four-stage model of the investment pipeline to measure the potential investment in Australia's resources and energy sectors. Earlier stages of developing mining and energy projects, such as identifying deposits and exploration activities, are not included in the model. While these activities remain important, it is beyond the scope of this report to assess exploration activities on a project-by-project basis. Instead, a summary and analysis of aggregate exploration expenditure is provided. To be included on the major projects list that accompanies this report, there must be evidence of project activities that support the project progressing to an FID within the next five years.

The four stages in the OCE investment pipeline model are: publicly announced, feasibility, committed and completed.

Publicly announced stage

Projects at the publicly announced stage are usually very early in their development, and are typically undergoing an initial feasibility study to assess the commercial aspects of developing an identified resource. To include a project on the list at this stage, preliminary information on the project schedule, planned output or cost must be publicly available. Projects that have stalled in progressing towards an FID, and that are investigating alternative development options, are also classified as Publicly Announced to reflect their longer planning times.

As they are still in early planning stages, projects at the publicly announced stage may not have finalised the engineering designs or estimates of construction costs. To reflect this uncertainty, project costs are quoted as a cost band in the Major Projects list. In most cases, this is based upon an estimate developed by OCE using industry averages for similar construction activities. The cost bands used by the OCE in this report for publicly announced projects are:

- $0 – $249m
- $250m – $499m
- $500m – $999m
- $1,000m – $1,499m
- $1,500m – $2,499m
- $2,500m – $4,999m
- $5,000m+

Feasibility stage

This stage of the project development cycle is when the initial feasibility study for a project has been completed and the results support further development. Projects that have progressed to the feasibility stage have undertaken initial project definition studies and commenced more detailed planning work. This work includes Front-End Engineering Design studies, Bankable Feasibility Studies, developing the final project scope, commercial plans and environmental surveys (in support of finalising an Environmental Impact Statement).

While there is an opportunity to progress projects at the feasibility stage to the committed stage, this is not guaranteed to occur, as the evaluation of commercial prospects has not yet been finalised and all regulatory approvals are yet to be received. Projects at the feasibility stage have not been committed to, and are only potential investments that may occur under the appropriate conditions. Therefore, the total value of projects at the feasibility stage cannot be directly compared to the value of the projects at the committed stage — in order to forecast the future of capital investment in Australia's resources and energy sectors.

Committed stage

Projects at the committed stage have completed all commercial, engineering and environmental studies, received all necessary Government regulatory approvals, and finalised the financing of the project to allow construction. Such projects are considered to have received a positive FID from the owner(s). In most cases, projects at this stage of development have already started construction, as there are typically pre-works undertaken as part of exploration and design activities.

Projects at the committed stage typically have cost estimates, schedules, and mine outputs that are well defined and often publicly released. Most projects that progress to the committed stage will eventually commence production. Nevertheless, post-FID, there are still technical and financial risks that, if realised, can result in delays, scope changes and cost overruns, or even affect the commercial viability of a project and possibly lead to its cancellation.

Completed stage

A project reaches the completed stage when construction and commissioning activities are substantially completed and full commercial level production has commenced. As many projects include multiple stages and scope elements that can be independent of each other, the timing around when a project reaches the completed stage can be difficult to assess.

15.3 Exploration

Exploration is a key stage in the mining project development cycle. It is an investment in knowledge about the location, type, quantity and quality of deposits, which helps to inform future development. Before making the decision to undertake exploration activities, resources and energy companies consider a range of factors to ensure the benefits of exploration activities exceed the costs. Factors to be considered include initial and long term land access agreements, prevailing and expected commodity prices, regulatory environments, geological prospects, and tax and royalties arrangements.

Exploration expenditure continues to decline

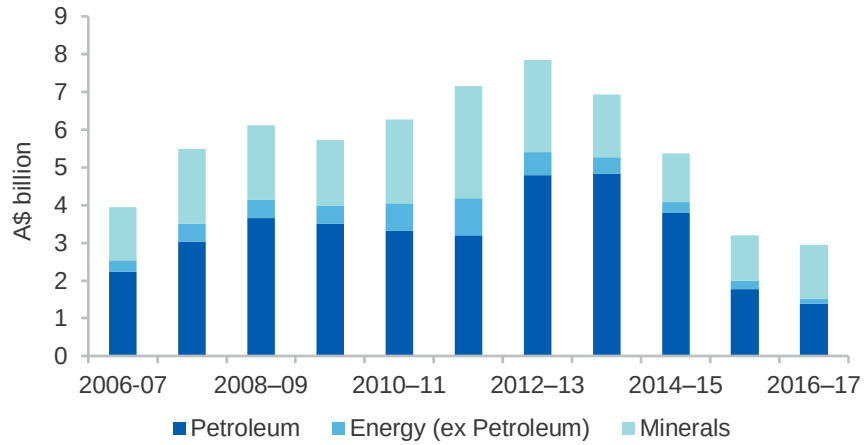
Australian exploration expenditure fell by 8 per cent in 2016–17 to $2.9 billion. The main contributor to the fall was lower petroleum exploration expenditure, which decreased by 23 per cent to $1.4 billion. The declines were smaller than in 2015–16, supported by a recovery in both onshore and offshore exploration activity in the first half of 2017. Nonetheless, both offshore and onshore petroleum expenditure remain around their lowest level in the last decade. Australia's wave of LNG investment saw exploration expenditure reach record levels between 2012 and 2014, but a difficult price environment has weighed on petroleum exploration expenditure since 2015.

Partially offsetting the fall in petroleum exploration is a rise in minerals exploration, up 10 per cent in 2016–17 to $1.6 billion. The increase in minerals exploration was largely driven by nickel, cobalt, and gold, all of which were subject to recent favourable movements in commodity prices.

Exploration expenditure on coal declined by 31 per cent in 2016–17, to $120 million, reflecting significant uncertainties around future movements in coal prices.

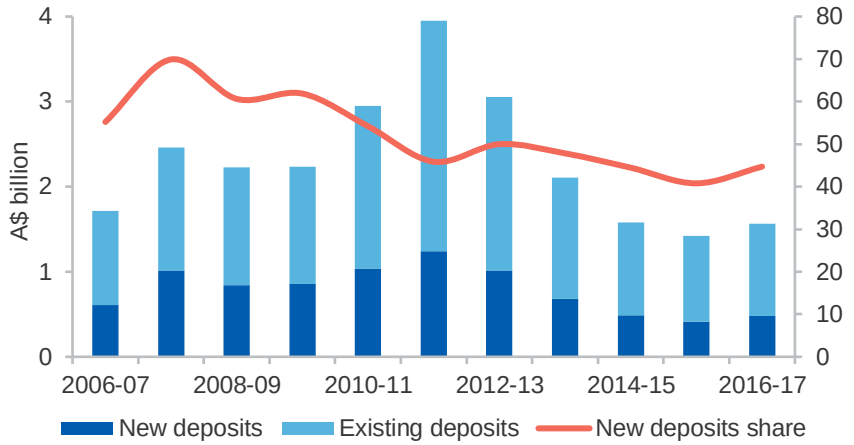
After 5 consecutive years of declines since 2012, exploration expenditure on iron ore has stabilised, remaining unchanged from 2015–16 levels of $291 million. Growing global supply and expectations of low prices have discouraged a rebound in exploration activity.

Figure 15.3: Exploration expenditure



Source: ABS (2017) Mineral and Petroleum Exploration, Australia, 8412.0

Figure 15.4: Mineral exploration by deposit type



Source: ABS (2017) Mineral and Petroleum Exploration, Australia, 8412.0

In 2016–17, mineral exploration expenditure targeting new and existing deposits increased by 17 and 7 per cent, to $0.5 and $1.1 billion, respectively. Market conditions encouraged exploration at new deposits, with greenfield exploration for mineral deposits not already known to exist becoming more appealing as commodity prices increased.

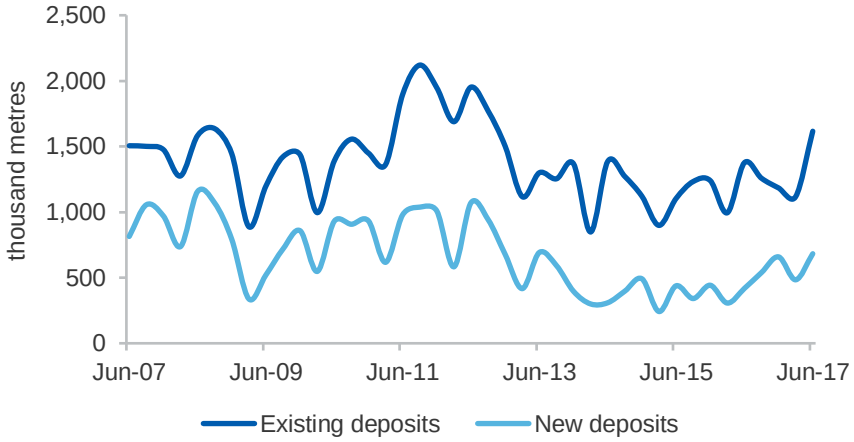
Gold exploration expenditure increased by 26 per cent in 2016–17 to $689 million — accounting for 44 per cent of Australia's total minerals exploration expenditure during the financial year. Exploration activity has been encouraged by higher world gold prices and the lower AUD/USD, which has improved the profit margins of Australian gold producers.

Base metals exploration expenditure rose by 17 per cent in 2016–17 to $271 million, supported by higher commodity prices. This was the first yearly improvement since low prices triggered a steady decline in 2012. Notably, Australia's copper exploration expenditure increased by 5 per cent, to $136 million — accounting for 50 per cent of Australia's total base metals exploration expenditure. The rise was driven by an improved outlook for copper prices.

Exploration expenditure on nickel and cobalt also recorded a strong rise in 2016–17, up by 59 per cent to $81 million. This was supported by an increase in nickel prices, following stronger than expected demand growth in China, which is seeking to increase its output of stainless steel.

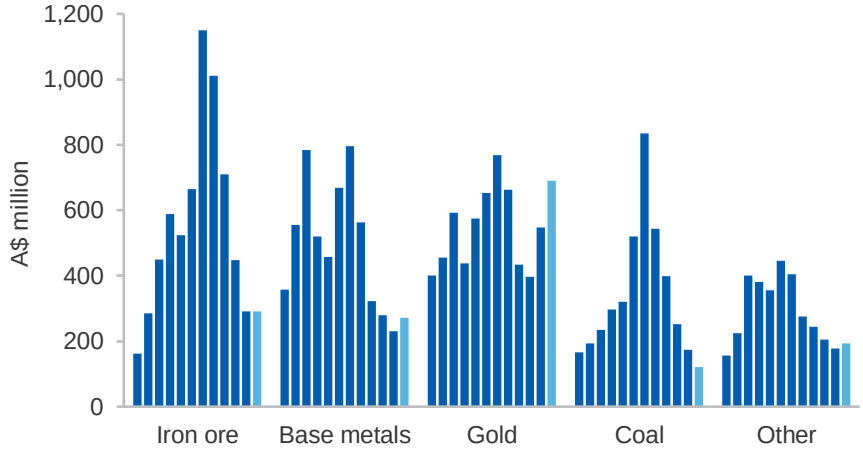
Other base metals recorded a rebound in exploration activity in 2016–17. Exploration expenditure on zinc, lead and silver increased by 10 per cent, to $55 million. Increased zinc prices also supported renewed interest among resource companies.

Figure 15.5: Minerals exploration, metres drilled quarterly



Source: ABS (2017) Mineral and Petroleum Exploration, Australia, 8412.0

Figure 15.6: Exploration expenditure by commodity, 2006–07 to 2016–17



Source: ABS (2017) Mineral and Petroleum Exploration, Australia, 8412.0

15.4 Projects at the publicly announced stage

Recently announced infrastructure projects will help to boost Australia's export capacity from the 2020s

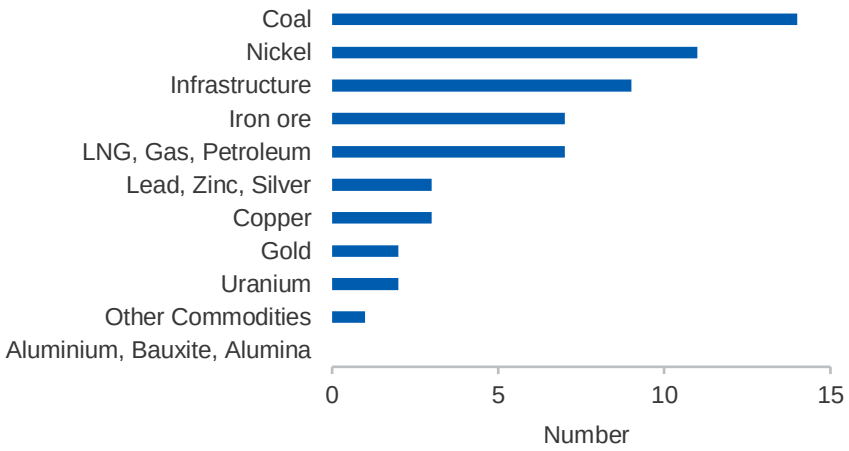
After 5 years of decline, the value of projects at the publicly announced stage picked up over the past twelve months to October, rising by almost $10 billion to $66 billion. This was driven in part by rising prices for commodities such as zinc and lithium, which have encouraged some fast-tracking and increased exploration for those minerals over the past twelve months.

Several nickel projects were publicly announced in the past twelve months, including BHP's Yakabindie mine in WA and Metallica Resources' Nornico mine in Queensland. The long-term feasibility of both projects remains under review, with underlying price movements over the next 12–24 months are likely to play an important role in the progression of the projects.

Some large infrastructure projects have also been announced in Queensland, notably the expansion work at the Port of Townsville, which is expected to occur in three stages (with completion in the 2020s).

The pipeline of new gas projects in the eastern gas market remains closely watched. Origin announced that it is targeting FEED on its Ironbark gas project in the Surat Basin — which it first acquired in 2009 — in 2017–18. Galilee Energy stated that it will proceed with FEED on its Glenaras gas project in the Galilee Basin in 2019, with production planned for 2022. Gas from the Glenaras project will be delivered to the east coast gas market with the assistance of the pipeline company Jemena.

Figure 15.7: Number of projects at the publicly announced stage 2017



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

15.5 Projects at the feasibility stage

A substantial number of projects remain stuck at the feasibility stage

The value of projects at the feasibility stage increased 4.5 per cent to $166 billion in 2017, the number of such projects remained steady at 125. The size and scale of mining projects has been falling for several years, and this is the first year this trend appears to have improved.

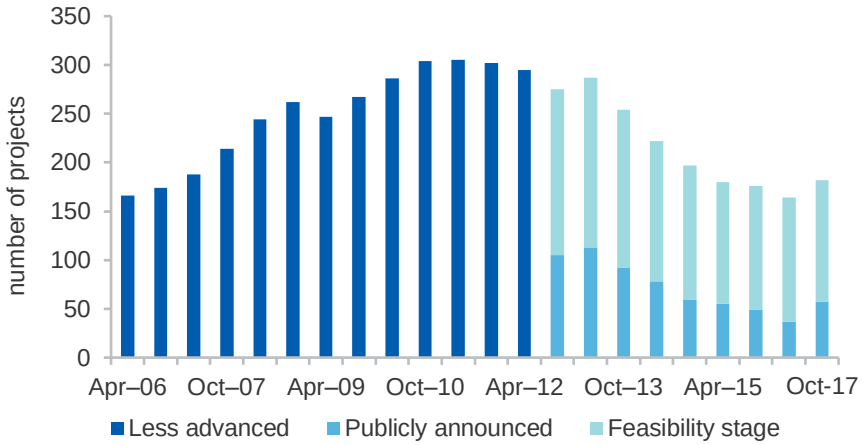
Current market conditions have led to a backlog of projects at the feasibility stage, as companies delay decisions to see how market conditions unfold. There are currently 40 coal projects at the feasibility stage, with several new ones being added over the past year.

Several iron ore projects reached the feasibility stage in 2017, with Fortescue Metals now considering two additional projects — Eliwana, within the Western Hub, and Iron Bridge in the Pilbara region. The Eliwana mine will maintain Australia's Hematite capacity if the project receives board approval.

Offsetting this were several large LNG projects, which were moved to the committed stage.

Woodside announced an expansion at the Pluto LNG project in Western Australia in February 2017, and is targeting an FID in the second half of 2018. Woodside has outlined two options for the expansion. The first — a debottlenecking task — would add around 0.7 million tonnes of production capacity. The second — an off-the-shelf train that would plug-in to the existing infrastructure — would add 1 to 1.5 million tonnes.

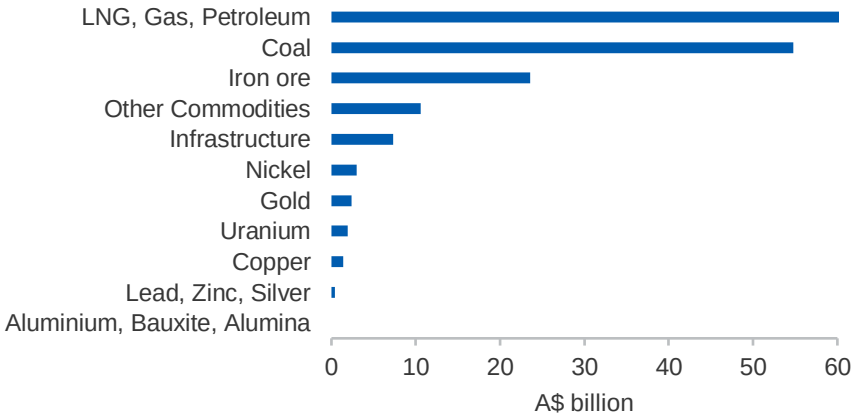
Figure 15.8: Number of uncommitted projects



Notes: 'less advanced' projects was the previous classification for projects at the publicly announced and feasibility stage.

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

Figure 15.9: Value of projects at the feasibility stage by commodity 2017



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

15.6 Projects at the committed stage

The value of committed projects has fallen away as fewer projects are judged feasible.

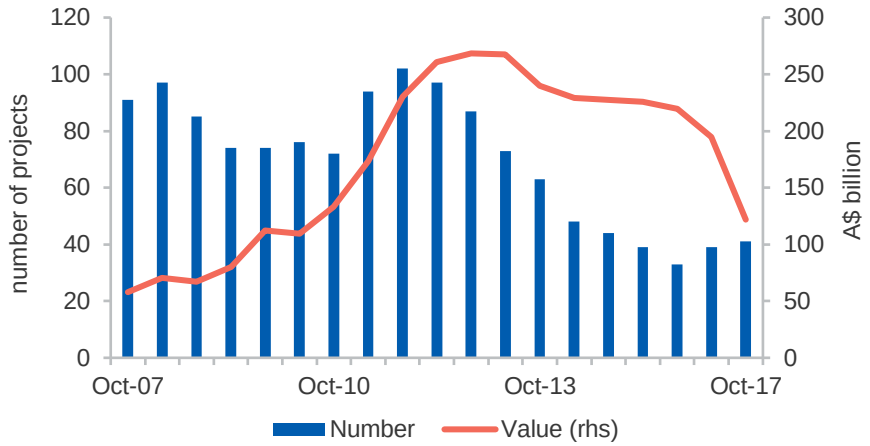
The value of projects at the committed stage declined sharply from $194 billion to $122 billion over the twelve months to end October 2017. This largely reflects the rising backlog of projects stranded at the feasibility stage, as well as the transition of several large LNG projects to completion.

The decline resulting from the completion of these projects was partially offset by FIDs for a number of projects across the gas, oil, copper and gold sectors. This included FIDs for Cooper Energy's $550 million Sole gas project, offshore of Victoria, and for upgrades to APA's $250 million Orbost Gas Plant (which will process gas from Sole). The Sole project — which has proved and probable reserves of 249 petajoules — is expected supply 24 petajoules of gas into the east Australian market from 2019.

The Wheatstone LNG project in Western Australia remained at the committed stage of development in 2017. While Wheatstone produced its first LNG from train 1 in October, Train 2 is not expected to be completed until sometime between April and June 2018.

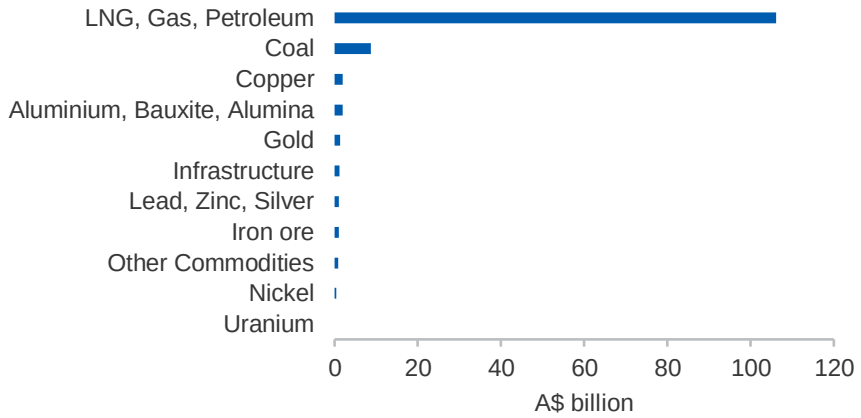
Newly committed gold projects include the MT Morgans project in Western Australia, (which is expected to add significant capacity from its start-up date in 2018) as well as projects at Dalgaranga, Dargues Reef and Kalawinda. Two new copper projects were also subject to final approval — the Carrapateena mine in South Australia and the Mount Gordon mine in Queensland — both of which are expected to start up by 2019.

Figure 15.10: Number and Value of committed projects



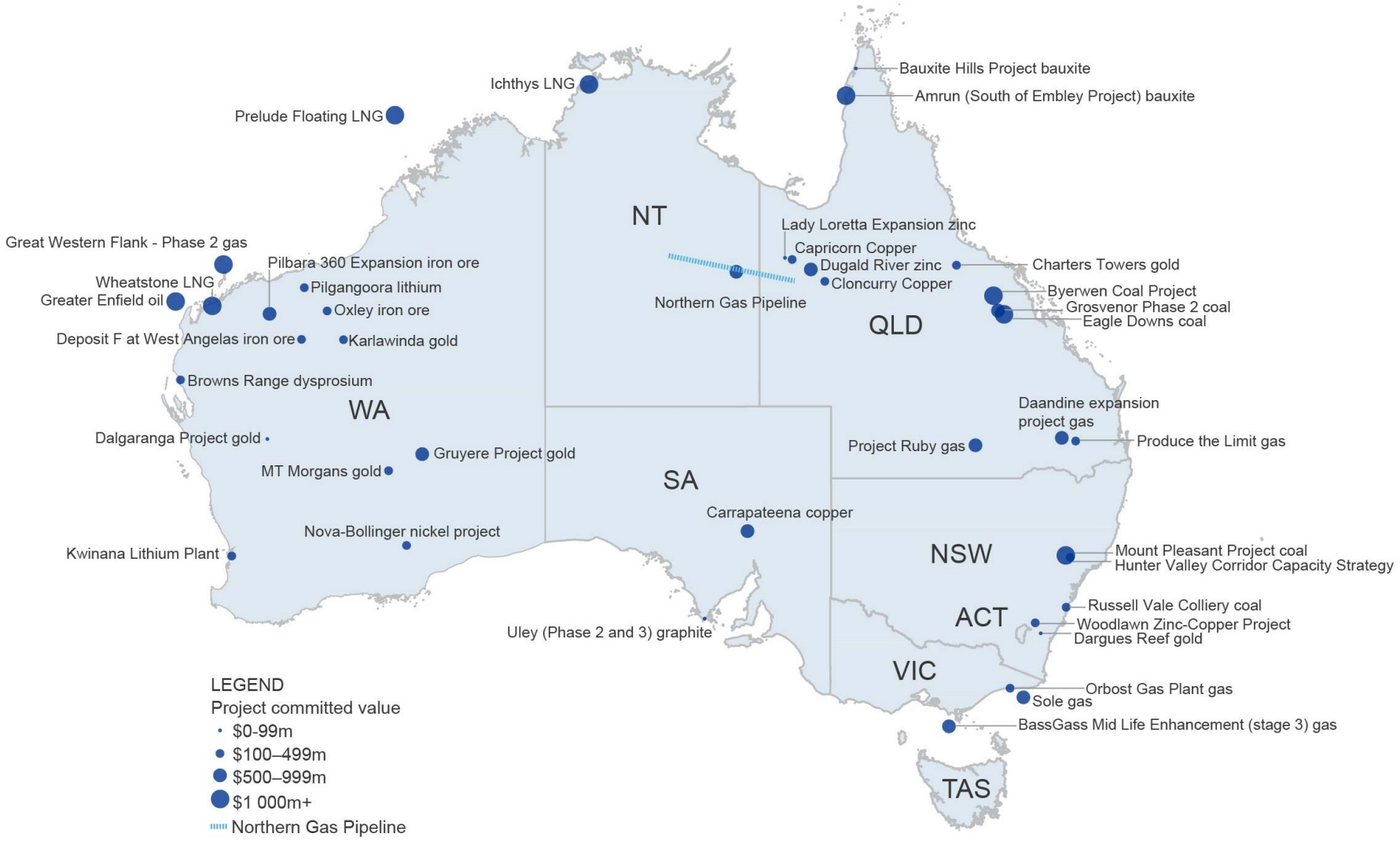
Source: Department of Industry, Innovation and Science (2017)

Figure 15.11: Value of committed projects by commodity 2017



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

Image 15.1: Location of projects at the committed stage



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

15.7 Projects at the completed stage

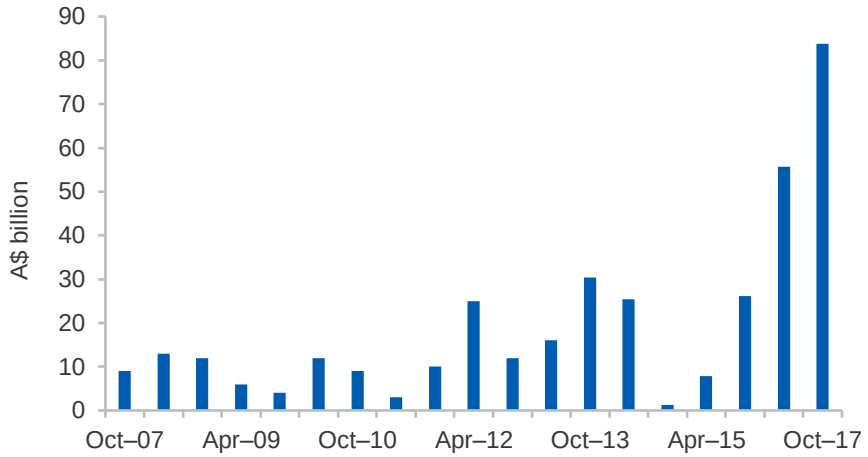
The value of projects at the completed stage has increased with the Gorgon gas project's completion.

22 projects — valued at $84 billion — progressed to the completed stage in the twelve months to October 2017. This was largely due to the completion of the largest project on the Resources and Energy Major projects list: the US$54 billion Gorgon LNG project in Western Australia. The third and final train at Gorgon started producing LNG in March 2017, bringing the nameplate capacity of the project to 15.6 million tonnes per annum. QGC's $1.7 billion Charlie gas project also progressed to the completed stage.

Coal projects remain largely focused on high quality coal, with two such projects completed in 2017. Expansion has concluded on BHP's Appin project in NSW, which is expected to add significantly to coking coal output at the site. Anglo American's Grosvenor coal mine was also completed in 2017.

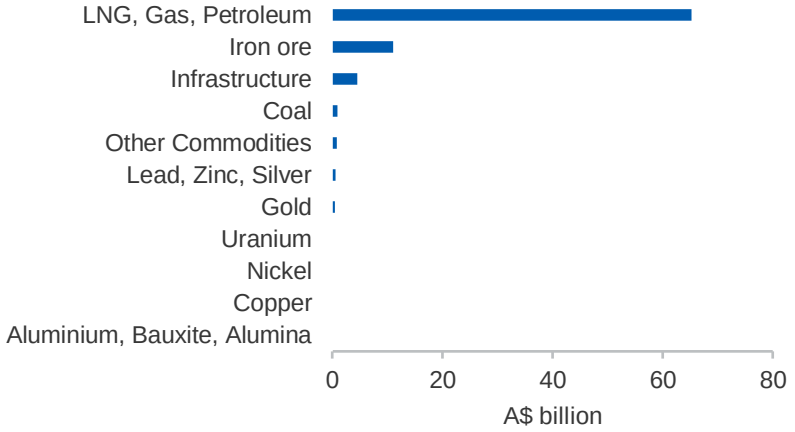
Other completed projects include the redevelopment of the Port Pirie mine, which will extract lead, zinc and copper in South Australia. 2017 also saw the commencement of the world's first modular ammonium nitrate plant in Western Australia.

Figure 15.12: Value of completed projects



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

Figure 15.13: Value of completed projects by commodity 2017



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

15.8 Outlook for resources and energy investment

The value of committed projects is expected to fall sharply in 2018, driven by the completion of the three remaining mega-projects in the project pipeline. The three LNG projects — Wheatstone, Ichthys, and Prelude — have a combined value of around $100 billion and are scheduled for completion by the end of 2018.

Box 15.1: Methodology

While the resources boom over the past decade stimulated considerable investment in Australia's resources and energy sector, not all projects that were initiated ended up progressing through to construction. Accordingly, projects at the publicly announced and feasibility stages can only be viewed as potential investment.

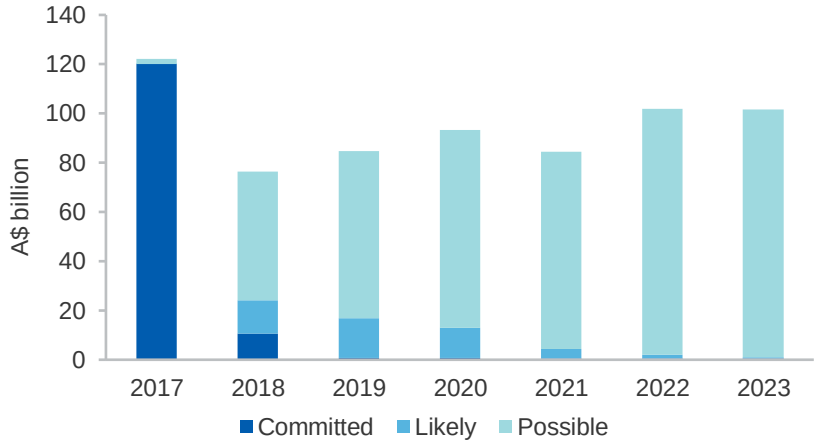
Resources and Energy Major Projects employs a project-level analysis to provide a profile of future investment. Projects at the feasibility and publicly announced stages are rated as either 'likely', 'possible' or 'unlikely' to progress to the committed stage. This assessment is based on a range of internal and external factors. Where data is available, projects are assessed based on their position on the relevant commodity's cost curve. The timing of when projects are likely to progress to the committed stage is based on schedules announced by the project's developers. Projects that have been assessed as 'unlikely' to proceed are not included in the forward projection of the value of committed investment.

Although assessments are made at a project level, these are not provided in the Resources and Energy Major Projects analysis because some of the information used is treated as commercial in confidence.

Woodside's Wheatstone project is likely to be the first of the three projects completed, with train 2 due online between April and June 2018. First LNG at Inpex's Icthys project is expected to be completed in the March quarter 2018, with some reports indicating that train 2 could commence operations as soon as a few months later. The Prelude Floating LNG project is likely to be the last of Australia's recent wave of seven LNG projects to be completed, with Shell indicating Prelude will be completed between May and August 2018.

Challenging market conditions over the past few years has encouraged Australian producers to focus capital investment towards lowering the cost of existing operations and increasing output. New, large scale low-cost projects are expected to drive investment in 2022 and beyond. Over 66 per cent of possible investment in 2022 and 2023 is attributed to just nine new large scale projects in gas, coal and iron ore.

Figure 15.14: Scenarios for committed project investment



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

Table 15.2: Summary of projects at the publicly announced stage

	NSW		Qld		WA		NT		SA		Vic		Tas		Total	
	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m
Aluminium ,Bauxite, Alumina															0	0
Coal	4	2,000-3,746	10	10,500-16,491+											14	12,500-20,237+
Copper			1	250 – 499	2	500 – 1,248									3	750 – 1,747
Gold					1	0 - 249	1	0 - 249							2	0 - 498
Infrastructure			4	3,500 – 6,495	3	6,000-6,998+									7	5,250 – 9,991+
Iron ore					5	3,500-7,495			2	1,750-2,998					7	5,250 – 10,493
Lead, Zinc, Silver	1	0 - 249	1	0 - 249	1	0 - 249									3	0 - 747
LNG, Gas, Petroleum			2	3,000 – 4,998	4	16,500-17,499+	1	5,000–5,000+							7	24,500–27,497+
Nickel			2	250 - 748	9	3,500 – 8,241									11	3,750 – 8,989
Other Commodities											1	250 - 499			1	250 - 499
Uranium			1	250 - 499	1	0 - 249									2	250 - 499
Total	**5**	2,000-3,995	20	17,750-29,979+	26	25,500-37,978+	2	5,000-5,249+	2	1,750-2,998	1	500 - 998			57	52,500-81,197+

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

Table 15.3: Summary of projects at the feasibility stage

	NSW		Qld		WA		NT		SA		Vic		Tas		Total	
	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m
Aluminium ,Bauxite, Alumina															0	0
Coal	5	4,168	27	50,476							1	143			33	54,787
Copper	1	131			1	202	1	190	2	563	1	291			6	1,376
Gold	1	215	1	134	5	969	1	1,046							8	2,364
Infrastructure	1	351	4	5,084	1	1,250			1	663					7	7,349
Iron ore	1	2,900			12	15,386			3	5,250					16	23,536
Lead, Zinc, Silver	1	350			1	70									2	420
LNG, Gas, Petroleum	1	2,000	4	3,800	5	54,500					2	540			12	60,749
Nickel					2	2,960									2	2,960
Other Commodities	7	1,798	5	1,473	11	2,974	4	2,676	2	193	4	1,186	2	290	35	10,590
Uranium			1	350	3	1,565									4	1,915
Total	**18**	**11,913**	**42**	**61,317**	**41**	**79,876**	**6**	**3,912**	**8**	**6,669**	**8**	**2,160**	**2**	**290**	**125**	**166,046**

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

Table 15.4: Summary of projects at the committed stage

	NSW		Qld		WA		NT		SA		Vic		Tas		Total	
	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m
Aluminium, Bauxite, Alumina			2	1,963											2	1,963
Coal	2	1,750	3	4,794											5	6544
Copper			2	481					2	1,510					4	1,991
Gold	1	80	1	246	4	948									6	1,275
Infrastructure	1	326					1	800							2	1,126
Iron ore					3	966									3	966
Lead, Zinc, Silver	1	140	2	871											3	1,011
LNG, Gas, Petroleum			3	1,100	4	61,200	1	42,567			3	1,300			11	106,167
Nickel					1	443									1	443
Other Commodities					3	843			1	50					4	893
Uranium															0	0
Total	**5**	**2,296**	**13**	**9,455**	**15**	**64,400**	**2**	**43,367**	**2**	**1,560**	**3**	**1,300**	**0**	**0**	**41**	**122,379**

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

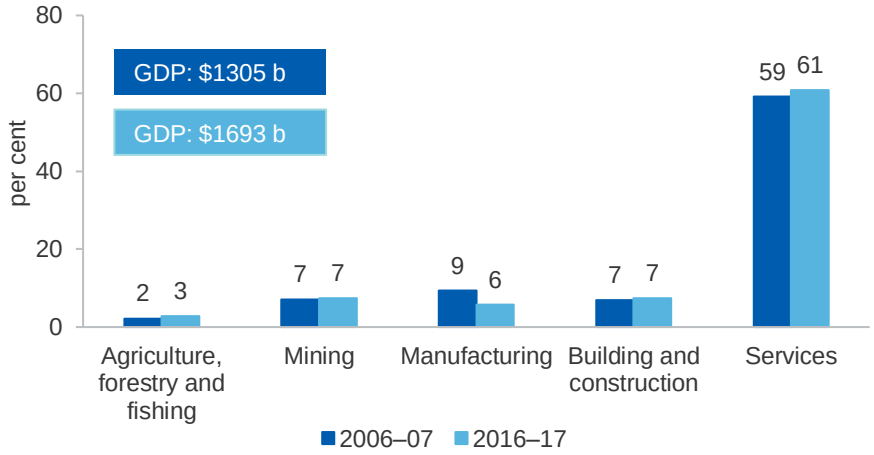
Table 15.5: Summary of projects at the completed stage

	NSW		Qld		WA		NT		SA		Vic		Tas		Total	
	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m	No. of projects	Value A$m
Aluminium, Bauxite, Alumina															0	0
Coal	3	1,389	2	180											5	1,569
Copper															0	0
Gold					3	328	1	120							4	448
Infrastructure			2	4,440	1	140									3	4,580
Iron ore					2	11,038									2	11,038
Lead, Zinc, Silver									1	563					1	563
LNG, Gas, Petroleum			1	1,700	3	62,065					2	1,200			6	64,965
Nickel															0	0
Other Commodities					1	800									1	800
Uranium															0	0
Total	**3**	**1,389**	**5**	**6,320**	**11**	**74,371**	**1**	**120**	**1**	**563**	**2**	**1,200**	**0**	**0**	**22**	**83,963**

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

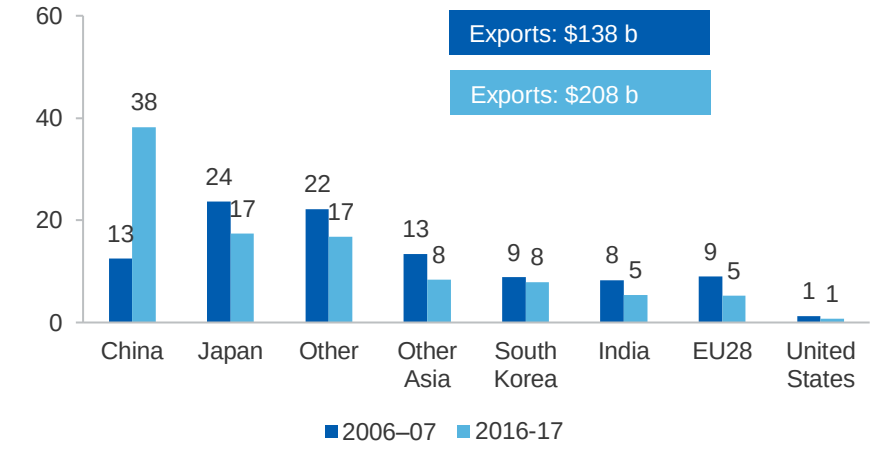
Trade summary charts

Figure 16.1: Contribution to GDP



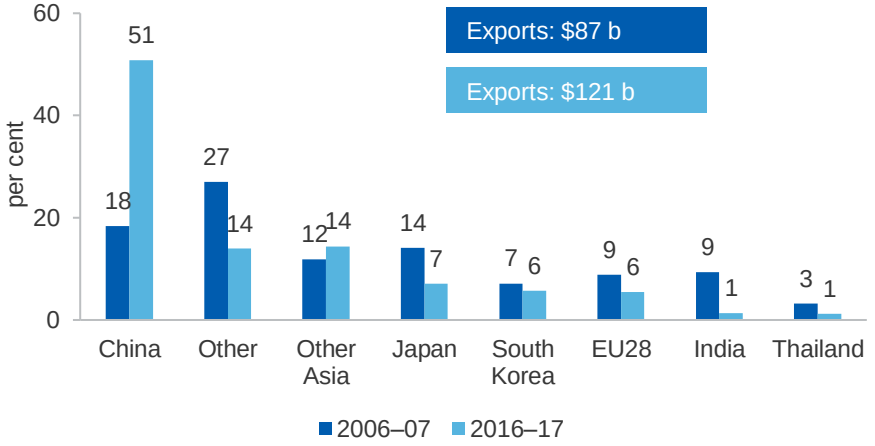
Source: ABS (2017) Australian National Accounts, National Income, Expenditure & Production, 5204.0

Figure 16.2: Figure 16.2: Principal markets for Australia's resources and energy exports, 2017–18 dollars



Source: ABS (2017) International Trade in Goods and Services, 5368.0

Figure 16.3: Principal markets for Australia's resources exports, 2017–18 dollars

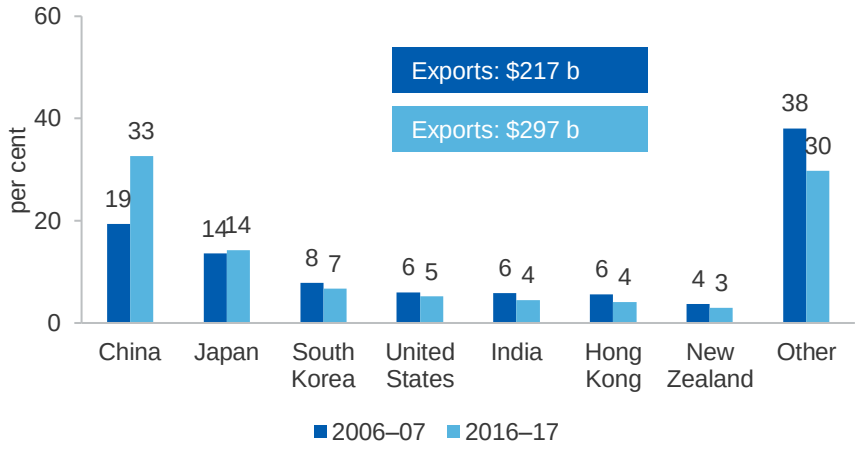


Source: ABS (2017) International Trade in Goods and Services, 5368.0

Figure 16.4: Principal markets for Australia's energy exports, 2017–18 dollars

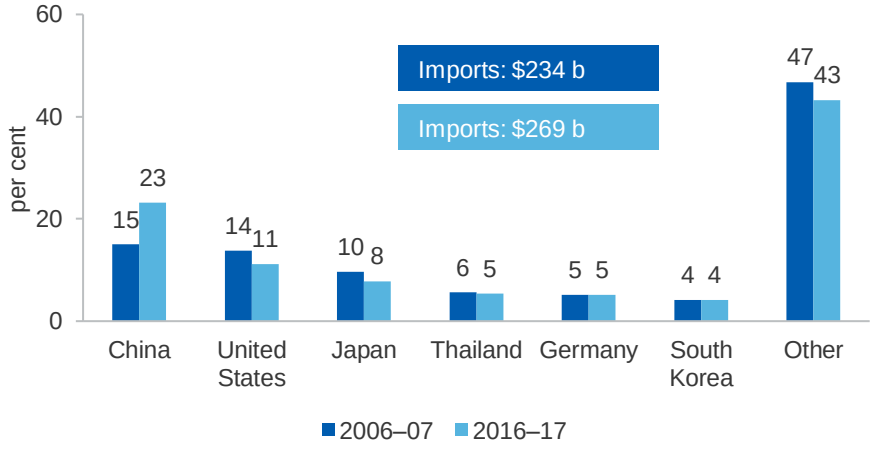
Source: ABS (2017) International Trade in Goods and Services, 5368.0

Figure 16.5: Principal markets for Australia's total exports, 2017–18 dollars



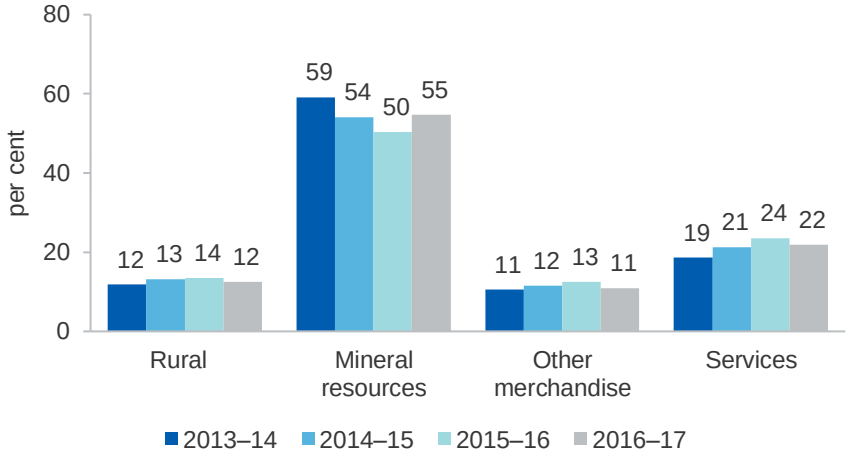
Source: ABS (2017) International Trade in Goods and Services, 5368.0

Figure 16.6: Principal markets for Australia's total imports, 2017–18 dollars



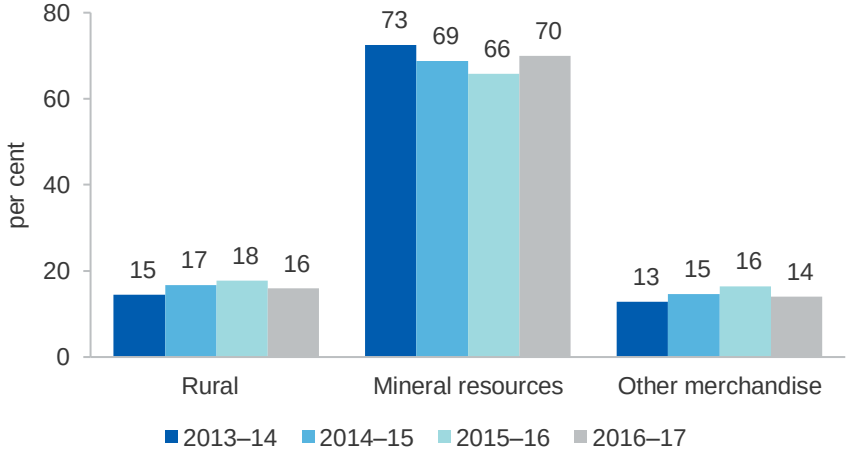
Source: ABS (2017) International Trade in Goods and Services, 5368.0

Figure 16.7: Proportion of goods and services exports by sector



Source: ABS (2017) Balance of Payments and International Investment Position, 5302.0, Department of Industry, Innovation and Science (2017)

Figure 16.8: Proportion of merchandise exports by sector



Source: ABS (2016) Balance of Payments and International Investment Position, 5302.0, Department of Industry, Innovation and Science (2017)

Table 16.1: Principal markets for Australia's thermal coal exports, 2017–18 dollars

	Unit	2012–13	2013–14	2014–15	2015–16	2016–17
Japan	$m	8,503	8,210	7,471	7,102	8,404
South Korea	$m	3,183	3,698	2,880	1,798	3,579
China	$m	2,974	2,953	2,809	2,618	2,617
Taiwan	$m	1,830	1,768	1,860	1,636	2,306
Malaysia	$m	298	369	614	510	657
Thailand	$m	260	308	287	326	297
Total	**$m**	**17,817**	**17,881**	**16,910**	**15,312**	**19,292**

Source: ABS (2017) International Trade in Goods and Services, 5368.0

Table 16.2: Principal markets for Australia's metallurgical coal exports, 2017–18 dollars

	Unit	2012–13	2013–14	2014–15	2015–16	2016–17
India	$m	5,043	5,149	5,278	4,787	8,560
Japan	$m	6,548	5,887	4,855	4,527	7,082
China	$m	5,063	6,269	5,024	4,022	7,811
South Korea	$m	2,671	2,631	2,505	2,167	3,765
Taiwan	$m	1,269	1,246	1,200	1,009	1,862
Netherlands	$m	1,069	1,074	876	950	1,925
Total	**$m**	**24,665**	**24,891**	**22,955**	**20,542**	**36,091**

Source: ABS (2017) International Trade in Goods and Services, 5368.0

Table 16.3: Principal markets for Australia's crude oil and refinery feedstocks exports, 2017–18 dollars

	Unit	2012–13	2013–14	2014–15	2015–16	2016–17
Singapore	$m	2,439	2,114	1,914	654	1,033
Indonesia	$m	330	331	35	368	937
China	$m	2,166	5	28	732	721
Thailand	$m	897	1,748	1,327	721	575
South Korea	$m	1,701	681	1	466	459
Malaysia	$m	879	314	4	150	436
Total	**$m**	**11,485**	**11,897**	**9,109**	**5,651**	**5,588**

Source: ABS (2017) International Trade in Goods and Services, 5368.0

Table 16.4: Principal markets for Australia's LNG exports, 2017–18 dollars

	Unit	2012–13	2013–14	2014–15	2015–16	2016–17
Japan	$m	14,055	16,115	15,065	10,932	11,545
China	$m	656	682	1,376	3,051	5,821
South Korea	$m	691	469	1,001	1,742	2,608
India	$m	0	0	0	523	627
Chinese Taipei	$m	287	186	42	166	304
Malaysia	$m	0	0	117	195	168
Total	**$m**	**15,690**	**17,452**	**17,779**	**17,206**	**22,758**

Notes: ABS data for LNG exports by destination in 2016–17 and total LNG exports. Australia's LNG exports by destination before 2016–17 are estimates based on International Trade Centre data.
Source: ABS (2017) International Trade in Goods and Services, 5368.0; International Trade Centre (2017) International Trade Statistics 2001–2017

Table 16.5: Principal markets for Australia's iron ore exports, 2017–18 dollars

	Unit	2012–13	2013–14	2014–15	2015–16	2016–17
China	$m	46,107	61,043	44,307	40,250	52,657
Japan	$m	9,472	10,344	7,047	4,860	5,493
South Korea	$m	5,417	6,527	4,259	3,169	4,002
Taiwan	$m	1,646	1,830	1,365	1,060	1,466
Indonesia	$m	61	44	29	56	44
India	$m	52	44	115	7	5
Total	**$m**	**62,749**	**79,926**	**57,373**	**49,616**	**63,979**

Source: ABS (2017) International Trade in Goods and Services, 5368.0

Table 16.6: Principal markets for Australia's aluminium exports, 2017–18 dollars

	Unit	2012–13	2013–14	2014–15	2015–16	2016–17
South Korea	$m	745	729	808	1,158	755
Japan	$m	1,104	1,193	1,533	723	951
Taiwan	$m	501	475	514	309	210
Thailand	$m	410	333	306	283	319
China	$m	164	249	53	97	52
Indonesia	$m	273	209	144	98	155
Total	**$m**	**3,602**	**3,724**	**4,023**	**3,364**	**3,231**

Source: ABS (2017) International Trade in Goods and Services, 5368.0

Table 16.7: Principal markets for Australia's copper exports, 2017–18 dollars

	Unit	2012–13	2013–14	2014–15	2015–16	2016–17
China	$m	3,338	4,216	3,836	3,723	2,750
Japan	$m	1,775	1,739	2,094	1,482	1,375
Malaysia	$m	744	654	554	641	877
India	$m	1,220	1,012	845	532	697
South Korea	$m	482	625	384	509	455
Philippines	$m	155	305	264	228	393
Total	**$m**	**8,843**	**9,319**	**8,912**	**8,419**	**7,695**

Source: ABS (2017) International Trade in Goods and Services, 5368.0

Table 16.8: Principal markets for Australia's gold exports, 2017–18 dollars

	Unit	2012–13	2013–14	2014–15	2015–16	2016–17
China	$m	4,686	6,406	8,507	7,218	8,945
United Kingdom	$m	2,876	685	613	4,088	3,993
Hong Kong	$m	121	162	199	2,620	9,809
Singapore	$m	1,039	2,433	3,277	1,241	308
Thailand	$m	1,397	476	944	263	543
Switzerland	$m	315	369	16	90	230
Total	**$m**	**16,553**	**13,926**	**13,731**	**16,283**	**18,384**

Source: ABS (2017) International Trade in Goods and Services, 5368.0

Table 16.9: Spot prices, nominal quarterly average

	Unit	Jun–17	Sep–17	Dec–17 s	Mar–18 f	Jun–18 f	Sep–18 f	Dec–18 f	Mar–19 f	Jun–19 f
Alumina fob Australia	US$/t	296	338	321	311	315	318	308	305	302
Aluminium LME cash	US$/t	1,909	2,012	2,032	2,093	2,072	2,030	2,091	2,154	2,143
Copper LME cash	US$/t	5,665	6,347	6,730	6,664	6,505	6,324	5,868	6,223	6,397
Gold LBMA PM	US$/t	1,258	1,278	1,280	1,253	1,268	1,258	1,223	1,216	1,196
Iron ore fob Australia a	US$/t	57	65	56	57	55	50	48	49	49
Nickel LME cash	US$/t	9,234	10,528	10,946	11,320	12,100	11,180	11,150	11,090	11,070
Zinc LME cash	US$/t	2,597	2,963	3,100	3,060	3,000	2,950	2,950	2,850	2,850
LNG fob b	US$/MMBtu	6.9	7.0	6.9	7.7	7.6	7.7	7.3	7.0	7.3
Metallurgical coal c	US$/t	191	190	192	175	155	140	135	120	120
Thermal coal fob Newcastle 6000 kc	US$/t	79	93	94	85	76	74	72	71	70
Crude oil (WTI)	US$/bbl	48	48	54	55	54	51	50	54	53
Crude oil (Brent)	US$/bbl	50	52	60	58	58	56	54	58	57
Crude oil (Japan Customs Cleared)	US$/bbl	53	50	50	57	58	58	56	54	58
Uranium d	US$/t	21	20	21	25	28	28	28	28	28

Notes: fob free-on-board; kc calorific content; **a** At 62 per cent iron content estimated netback from Western Australia to Qingdao China; **b** Australia's export unit values; **c** Premium hard coking coal fob East Coast Australia; **d** Average of weekly restricted spot price published by The Ux Consulting Company; **f** forecast; **s** estimate.

Source: ABS (2017) International Trade in Goods and Services, Australia, Cat. No. 5368.0; LME; London Bullion Market Association; The Ux Consulting Company; US Department of Energy; Metal Bulletin; Japan Ministry of Economy, Trade and Industry; Department of Industry, Innovation and Science (2017)

Table 16.10: Australia's export values, nominal quarterly

	Unit	Jun–17	Sep–17	Dec–17 s	Mar–18 f	Jun–18 f	Sep–18 f	Dec–18 f	Mar–19 f	Jun–19 f
Iron ore	$m	14,953	16,297	15,586	15,054	15,101	13,793	13,028	12,375	13,036
Gold	$m	4,554	4,069	4,216	4,186	4,171	4,148	3,923	3,990	3,949
Copper	$m	2,046	1,729	2,127	2,282	2,208	2,335	2,010	2,129	2,206
Alumina	$m	1,830	1,618	1,880	1,810	1,891	1,736	1,724	1,652	1,714
Aluminium	$m	836	911	1,023	941	915	950	1,010	935	911
Zinc	$m	780	807	709	766	710	801	773	813	732
Bauxite	$m	284	276	249	236	260	273	245	241	265
Nickel	$m	77	74	94	105	117	109	105	100	99
Other resources	$m	4,460	4,280	4,276	3,819	4,205	4,150	4,295	3,865	4,285
Total resources	**$m**	29,821	30,061	30,159	29,198	29,578	28,294	27,112	26,099	27,197
Metallurgical coal	$m	8,567	8,243	9,761	9,125	8,138	7,366	6,767	5,958	6,121
Thermal coal	$m	4,907	5,342	5,522	4,931	4,565	4,505	4,389	4,305	4,294
LNG	$m	6,447	6,488	7,072	8,140	8,211	9,414	9,270	8,895	8,813
Crude oil	$m	1,282	1,501	1,473	1,554	1,518	1,640	1,700	1,800	1,869
Uranium	$m	140	163	143	165	165	165	162	154	154
Other energy	$m	674	687	746	777	788	810	743	781	816
Total energy	**$m**	22,017	22,424	24,717	24,692	23,385	23,900	23,029	21,893	22,067
Total resources and energy	**$m**	51,838	52,485	54,876	53,891	52,963	52,195	50,142	47,992	49,264

Notes: **b** In 2017–18 Australian dollars; **f** forecast; **s** estimate

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


Appendix

A.1 Methodology and key assumptions

Commodity classifications

In this report, exports for each commodity are defined by a selected set of 8-digit Australian Harmonised Export Commodity Classification (AHECC) codes. Where possible, the choice of AHECC codes is based on alignment with international trade data, to ensure that direct comparisons can be made. For example, groupings for various commodities are aligned classifications used by the International Energy Agency, World Steel Association, International Nickel Study Group, International Lead and Zinc Study Group, International Copper Study Group and World Bureau of Metal Statistics.

In this report, benchmark prices and Australian production and exports are forecast for 21 commodities, as shown in Table A1 below. In estimating a total for Australia's resources and energy exports, the remaining commodities, defined as 'other resources' and 'other energy', are forecast as a group.

Value and price

In this report, all value and price data (unless otherwise specified) is in nominal Australian or US dollars.

If the real value or price is specified (mostly in the tables), the conversion from nominal to real dollars is based on the Australian and US consumer price indices.

Prices in future years are based on the median of economic forecasters at the time that this report was prepared. The source for this is Bloomberg's survey of economic forecasters.

Exchange rates

In this report, the exchange rate forecasts for the Australian/US dollar is based on the median of economic forecasters at the time that this report was prepared. The source for this is Bloomberg's survey of economic forecasters.

Table A1: Resources and energy commodities groupings and definitions

	Resources (non-energy)	Energy
Definition	Resource commodities are non-energy minerals and semi-manufactured products produced from non-energy minerals	Energy commodities are minerals and petroleum products that are typically used for power generation
Australian Harmonised Export Commodity Classification (AHECC) chapters	25 (part); 26 (part); 28 (part); 31 (part); 73 (part); 74; 75; 76; 78; 79; 80; 81	27 (part)
Commodities for which data is published, forecasts are made and analysed in detail in this report	Aluminium; alumina; bauxite; copper; gold; iron ore; crude steel; nickel; zinc	Crude oil and petroleum products; LNG; metallurgical coal; thermal coal; uranium
Commodities for which data is published, and forecasts are made	Lead; silver; tin; salt; diamonds; other resources	Other energy

Notes: The AHECC chapter is the first two digits of the trade code. Groupings are made at the 8-digit level.

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