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Office of the
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Foreword

This edition brings a significant change to our commodity forecasts. In recent years, we have predicted commodity export earnings would peak in 2018–19. As recently as March 2019, we suggested record earnings of \$278 billion in 2018–19, before earnings fell back in the following years. Our forecast for 2018–19 looks to be largely on target but, massive as this revenue is, it is increasingly likely that the peak will now be in 2019–20. Resource and energy commodity earnings in 2019–20 have been revised up by \$12.9 billion to \$285 billion.

The swing factor is iron ore prices. The fallout from the Brumadinho tailings dam collapse has led to a sharp drop in Brazilian iron ore exports, and this shortfall now looks set to last at least two years. The seaborne iron ore market is thus likely to stay tight, and prices elevated, out to at least 2021. Extra Australian output will partly fill the gap, as mining expands and disruptive weather in Western Australia recedes. The weaker Australian dollar outlook has also pushed up our 2019–20 forecast.

Partially offsetting this, thermal coal — Australia's 4th largest export commodity — is facing a tougher climate, with prices deteriorating in recent months. As a large producer and importer of thermal coal, China's import policies, including extended customs clearance times, have added uncertainty into the market. Seasonal factors appear to have had a larger than normal impact this year: the northern hemisphere — where most thermal coal is burnt — has emerged from a warmer than usual winter, which reduced heating-related energy use. Peak summer demand, when air conditioner usage rises, is a month away.

Like any forecast, these ones are not without their risks — the most notable being the worsening of trade tensions between the US and its major trading partners, particularly China. As we publish, the US and China are set for further trade discussions at the G20 meeting in Japan. Commodities helped to protect Australia from larger fallout during the Global Financial Crisis. However, the opposite could happen in a downturn sparked by trade disputes. Trade disruptions will hit global manufacturers

especially hard, and the impacts will inevitably flow on to the commodity producers who provide the raw materials to manufacturers. This could result in an outsized impact on nations with a high commodity exposure.

Many firms were able to absorb the initial 10 per cent tariff into their margins. However, the escalated 25 per cent tariff will force major changes to global supply chains. The fallout of these changes may actually favour some steel producers in unanticipated ways. Should the Chinese government proceed with further stimulus packages involving increased infrastructure spending, steel use could actually rise in net terms.

Geopolitics is magnifying uncertainties, especially in oil markets. Many oil producers are facing sanctions as well as domestic turmoil. The age of nuclear power began with the oil crisis of 1973 (a subject explored in this edition's uranium special topic). Any substantial rise in oil prices, and tight carbon budgets, may accelerate the age of electrification, as nations seek to reduce emissions and curb oil dependency by embracing electric cars.

As ever, economic turning points are hard to predict, and the prospect of one in the near future adds a significant element of uncertainty to our higher forecast. Should a turning point occur, our strength — record commodity exports — could also be our vulnerability.

This edition contains two special topics. The first dwells on the Australian gold industry. Australia has the world's largest economic demonstrated resources of gold, and gold is forecast to overtake thermal coal as our fourth largest export in 2019–20. The second special topic examines the uranium market, currently emerging from a sharp downturn after the power plant disaster at Fukushima. Uranium's long term prospects depend on a range of factors, such as climate change pressures, technological change, and the decisions of about 30 nations examining nuclear energy programs.



Mark Cully
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About this edition

The *Resources and Energy Quarterly* (REQ) contains the Office of the Chief Economist's forecasts for the value, volume and price of Australia's major resources and energy commodity exports.

A 'medium term' (five year) outlook is published in the March quarter edition of the *Resources and Energy Quarterly*. Each June, September and December edition of the *Resources and Energy Quarterly* features a 'short term' (two year) outlook for Australia's major resource and energy commodity exports. The December *Resources and Energy Quarterly* also includes the annual Major Projects update.

Underpinning the forecasts/projections contained in the *Resources and Energy Quarterly* is the Office of the Chief Economist's outlook for global resource and energy commodity prices, demand and supply. The forecasts/projections for Australia's resource and energy 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 forecasts/projections, by estimating the impact on Australian producers and the value of their exports.

In this report, commodities are grouped into two broad categories, referred to as 'resources' and 'energy'. 'Energy' commodities comprise metallurgical and thermal coal, oil, gas and uranium. 'Resource' commodities in this report are all other mineral commodities.

Unless otherwise stated, all Australian and US dollar figures in this report are in nominal terms. Inflation and exchange rate assumptions are provided in the Appendix to the 'Macroeconomics' chapter.

Data in this edition of the *Resources and Energy Quarterly* is current as of 20 June 2019.

Resources and Energy Quarterly publication schedule

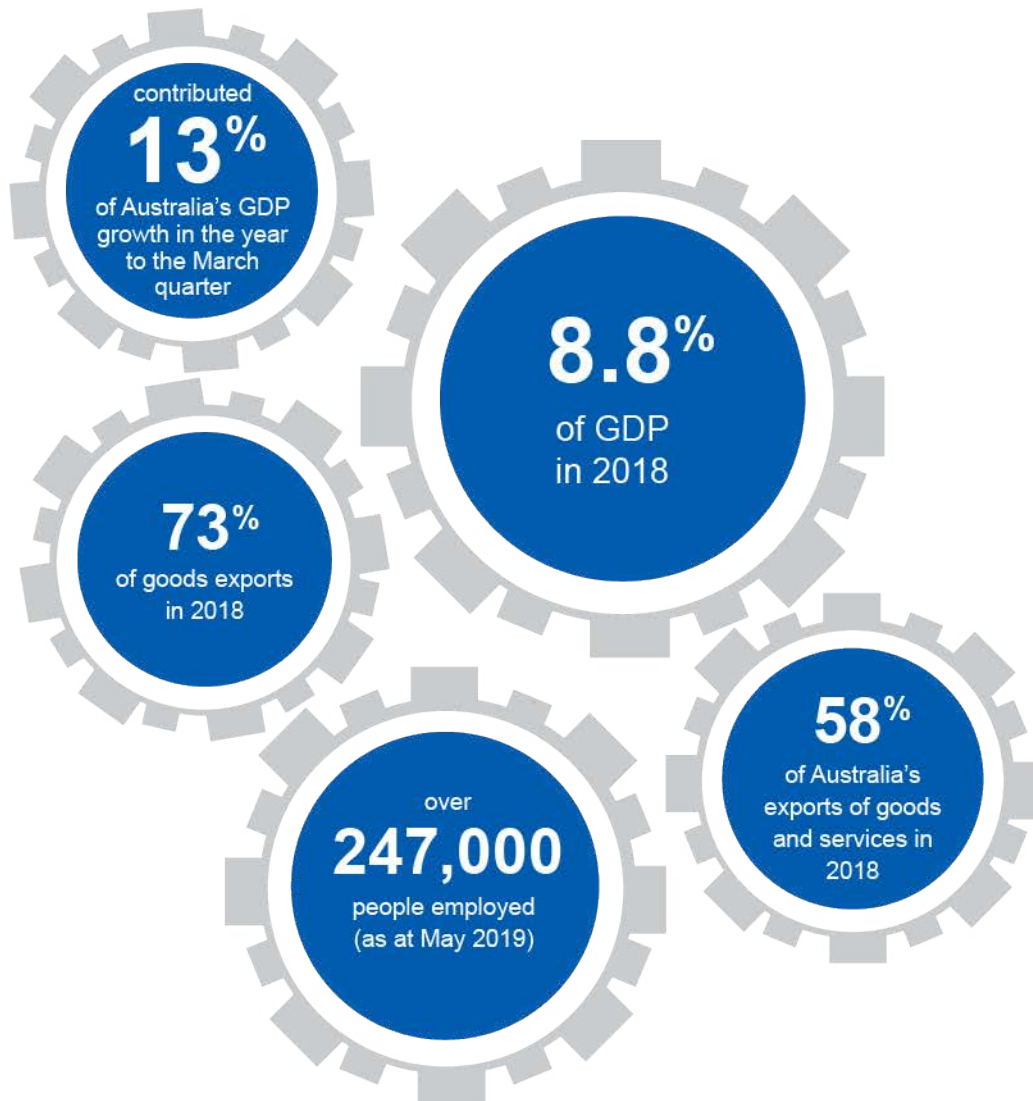
Publication	Expected release date	Outlook period
September 2019	30 September 2019	Australian data: 2020–21 World data: 2021
December 2019	19 December 2019	Australian data: 2020–21 World data: 2021
March 2020	30 March 2020	Australian data: 2024–25 World data: 2025
June 2020	6 July 2020	Australian data: 2021–22 World data: 2022

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

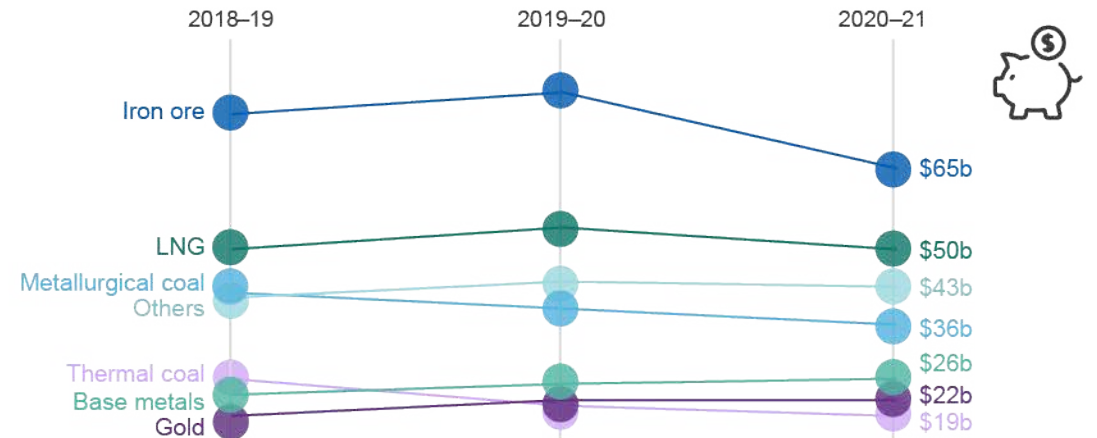
Overview

Resources and Energy Quarterly June 2019

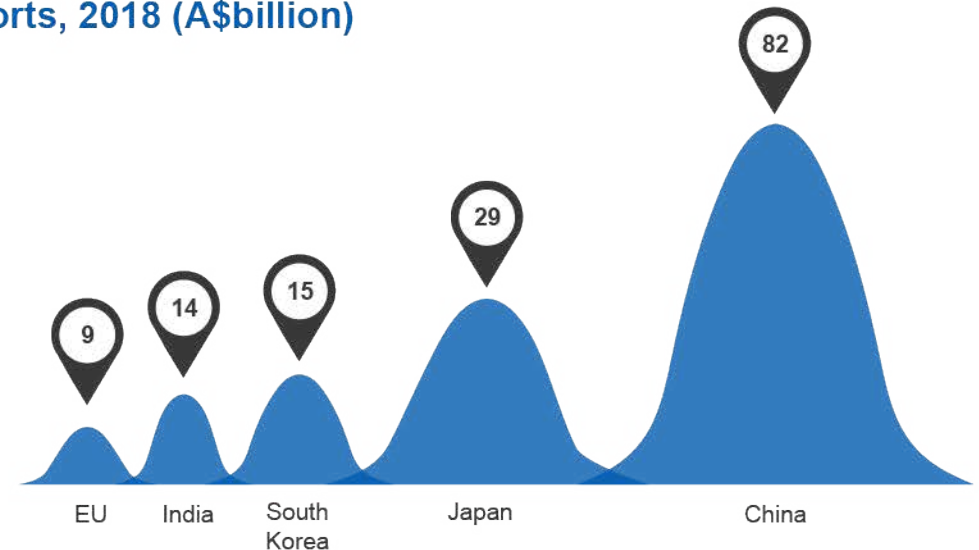
Resources and energy sector



Australia's resources and energy exports 2018–19, A\$billion



Major markets for Australia's resources and energy exports, 2018 (A\$billion)



1.1 Summary

- The prices of Australia's major resource commodities have recently hit 7-year highs, but are likely to drift lower over the outlook period, due to softer demand and rising supply.
- Resource and energy commodity markets have been buffeted by the impact of both US-China trade tensions and supply changes in recent months. Combined with a weaker than expected exchange rate, Australia's resource and energy exports are set to hit a new record of \$285 billion in 2019–20, before falling back in 2020–21.
- The world industrial production cycle has continued to slow in recent months, and looks set to slow further. The extent of the likely down-cycle in resource commodities depends on whether China can maintain recent rates of economic growth, and the unfolding of trade disputes of the US with its trading partners.

1.2 Export values

Australia's export values expected to be \$285 billion in 2019–20

The Office of the Chief Economist's (OCE) Resources and Energy Export Values Index rose by 17.5 per cent in the year to the June quarter 2019. A 2.5 per cent rise in volumes added to a 15.3 per cent rise in prices. Figure 1.2 shows that in 2018–19, an estimated 18.4 per cent rise in prices added to the impact of a 3.0 per cent rise in export volumes. Resource export earnings are thus estimated to have risen by 20.7 per cent to a record \$275 billion. 2019–20 is forecast to see export values rise by 3.4 per cent to \$285 billion, as a 6.8 per cent rise in volumes more than offsets a 3.2 per cent fall in prices. In 2020–21, weaker prices and a forecast rise in the AUD/USD will drive an 8.6 percent fall in export earnings to \$260 billion.

The ongoing weakness in the AUD/USD is boosting export earnings

In Australian dollar terms, the OCE's Resources and Energy Commodity Price Index rose by 0.4 per cent (preliminary estimate) in the June quarter, to be 15.3 per cent higher than a year earlier. In US dollar terms, the index grew by 1.5 per cent in the quarter, to be 9.7 per cent higher than a year earlier. Figure 1.3 shows that Australian dollar prices for resource commodities rose by 12.1 per cent in the June quarter, while prices of energy commodities fell by 11.0 per cent in the quarter.

Figure 1.1: Australia's resource and energy export values/volumes



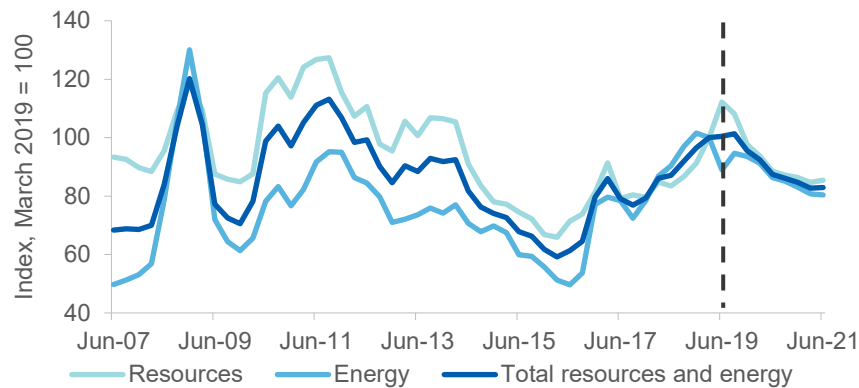
Source: ABS (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019)

Figure 1.2: Annual growth in Australia's resources and energy export values, contributions from prices and volumes



Source: Source: ABS (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019)

Figure 1.3: Resource and energy export prices, AUD terms



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 (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019)

1.3 Trade tensions and macroeconomic factors

The past quarter has seen the world economy continue to slow, and the signs are that a further slowdown is likely during the second half of 2019. US-China trade tensions appear to have played a significant part in this slowdown, and the escalation of those tensions in May looks likely to trigger a further slowdown in world trade, as global supply chains adjust (further) to new tariff regimes. Resource commodity markets are likely to be impacted over 2019–20, as consumers react to higher prices before supply chains switch to cheaper alternatives. The extent of the world slowdown will depend on the dexterity of central banks and the scope of governments to act in a way to offset the impact of the disruption.

The Chinese economy appears to have steadied at a lower pace of growth in the June quarter, after the authorities implemented a number of stimulatory measures aimed at offsetting the impact of the institution and escalation of US tariffs on Chinese goods. Chinese exporters are likely to struggle if the rate/coverage of US tariffs is raised again in the coming months. Chinese stimulatory measures, particularly increased government spending on infrastructure, is likely to boost the demand for raw materials

used in the construction of railways, highways, bridges, schools, hospitals and electricity transmission networks. Iron ore, coal and base metals could thus benefit from rising Chinese usage over the outlook period.

The sustainability of US economic growth is under a cloud, as the US-China trade tensions impact: with the income/corporate tax cuts of 2018 having largely washed through, much now depends on the stance of the US Federal Reserve and whether the US Administration and Congress can agree on increased infrastructure spending to boost US productivity and economic growth to offset fragile business confidence. For now, the US President has ruled out negotiating any agreement on an infrastructure program while the Democrat-controlled House of Representatives persists in investigating his Administration.

The ability of the US Federal Reserve to stem any US economic slowdown may depend partly on whether the central bank chooses to look through the inflationary impact of the sharp US tariff hikes on imports of Chinese goods. Making such monetary judgements becomes more difficult when the US economy is virtually at full employment. If the US economy does manage to remain at full employment, there may be limited capacity to expand production significantly if the US Administration is highly successful in its efforts to bring production facilities back onshore.

Outside the US, governments and central banks in other major Western nations/regions have limited ability to stimulate activity, due to already low interest rates and high fiscal deficits and debt. Central banks could restart quantitative easing measures. Eurozone growth has remained subdued, mainly due to slower growth in Germany and Italy (where the government's fiscal and debt standing is causing concern). The European Central Bank is keen to keep monetary conditions loose to assist growth.

The major risk to world growth is an escalation of protectionist trade measures between China/Europe/Japan and the US. A 'no-deal' Brexit could also cause significant disruption to global supply chains — notably in Europe. The vagaries of the weather will impact on energy commodity usage over the outlook period, however, the ongoing push to lower carbon emissions will unambiguously impact thermal coal demand adversely.

1.4 Prices

The iron ore price has lifted steadily over the past few months, as the mine closures in Brazil and Western Australia's weather problems caused a scramble for available cargoes. The iron ore price is forecast to decline modestly over the next two years (Figure 1.4), as growth in Chinese steel output eases and world supply recovers. However, prices are likely to be at least US\$10-15 a tonne higher in 2019-20 than they otherwise would have been without the problems in Brazil.

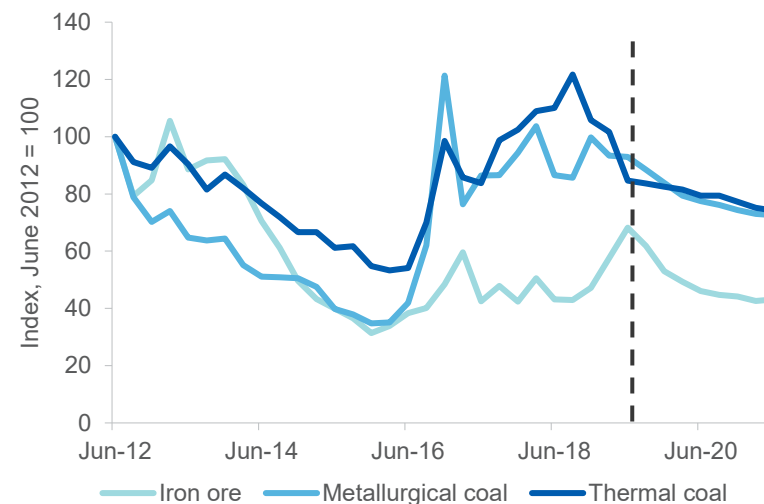
The price of metallurgical coal hovered around the US\$200 a tonne during the June quarter, as sluggish supply combined with strong demand — particularly from China. The price is likely to ease back over the outlook period. High energy thermal coal prices have declined much more sharply than low energy coal prices over the past quarter, pushing the spread back down towards 'normal' levels. Decade-low Asian gas prices are pushing thermal coal prices down. Thermal coal prices are forecast to ease further during the 2019–21 period, as supply rises and demand cools (Figure 1.4).

Oil prices have continued to swing around sharply but, despite recent weakness, remain above levels reached in late 2018. The market has been spooked by world slowdown concerns. With oil prices expected to hold above the US\$65 a barrel mark, Australia's growing oil, condensate and LNG exports (of which, around 90-95 percent are linked to oil prices) should result in record petroleum and LNG revenues.

Gold pushed above the US\$1,300 an ounce mark just as June began, propelled by safe-haven buying as equities fell and bonds rallied. Gold is forecast to benefit from strong central bank, investor and jewellery demand over the coming year or so. Base metal prices have ridden the US-China trade rollercoaster over the past quarter. With the exception of zinc, base metals are expected to rise over the outlook period (Figure 1.5), as the falling inventories more than overwhelm the impact of a world slowdown.

Rising resource and energy prices have driven a strong rebound in our terms of trade in the past three years, raising Australia's national income. The weaker Australian dollar continues to help cushion the economy from the impacts of the US-China trade war and the associated slowdown.

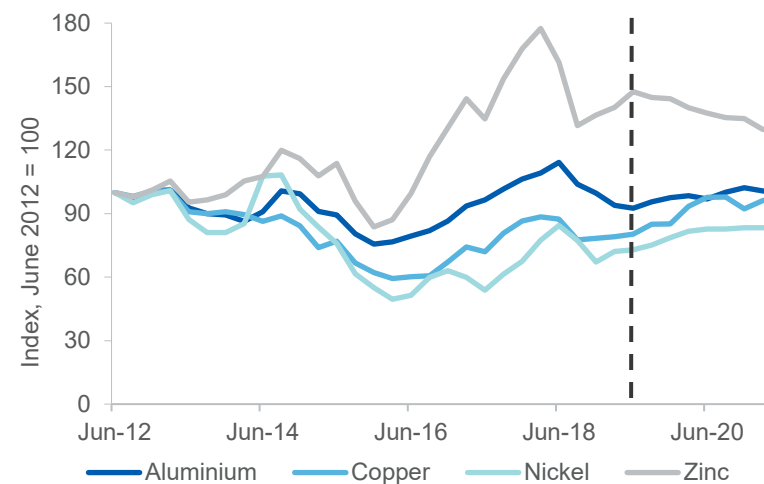
Figure 1.4: Bulk commodity prices



Notes: Prices are in US dollars, and are the international benchmark prices

Source: Bloomberg (2019)

Figure 1.5: Base metal prices



Notes: Prices are in US dollars, and are the international benchmark prices

Source: Bloomberg (2019)

1.5 Export volumes

Export volumes to grow, driven by growing energy exports

Most energy and resource commodities recorded growth in the year to the June quarter. Cyclonic weather in the Pilbara region in Western Australia (just as the June quarter began) impacted on port operations and inhibited iron ore exports. The OCE's Resources and Energy Export Volumes Index (preliminary estimate) rose by 2.5 per cent in the June quarter 2019 year-on-year, taking the index to a record high. Energy commodity volumes rose by 11.1 per cent but resource commodity volumes fell by 5.9 per cent.

Volumes are expected to show further strong (largely across-the-board) growth in 2019–20, before moderating in 2020–21.

1.6 Contribution to growth and investment

Mining industry continues to support overall economic growth

Australia's real Gross Domestic Product (GDP) grew by 0.4 per cent in the March quarter 2019 and by 1.8 per cent over the year. The mining industry directly accounted for 13 per cent of the growth in Australia's GDP in the year to the March quarter.

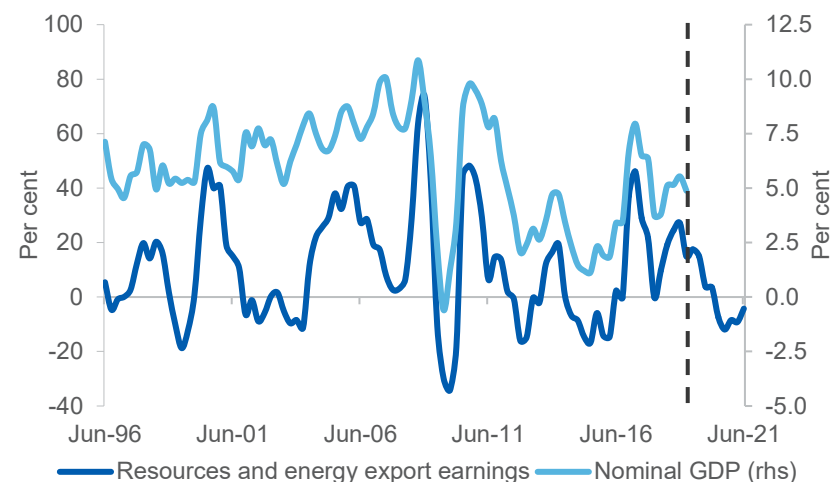
Mining output grew by 3.0 per cent in the year to the March quarter 2019. Mining value-added rose by 0.8 per cent in the March quarter, mostly driven by growth in oil and gas extraction.

Oil and gas extraction has been the largest contributor to mining industry value-added growth in the last few years, propelled by growing export volumes associated with the LNG export boom. In the coming few years, with ramp-up in the large LNG projects complete, lower export growth and relatively low investment in the oil and gas production sector are expected to provide a smaller contribution to Australia's GDP growth.

Since the global financial crisis, swings in Australian resource and energy export earnings have correlated very closely with swings in nominal GDP. Figure 1.6 suggests that, with growth in resource and energy export values likely having peaked in early 2019, if the correlation persists, nominal GDP

growth could weaken noticeably over the next year — though from a relatively high base.

Figure 1.6: Australia's nominal GDP vs resource and energy commodity export earnings, annual per cent change



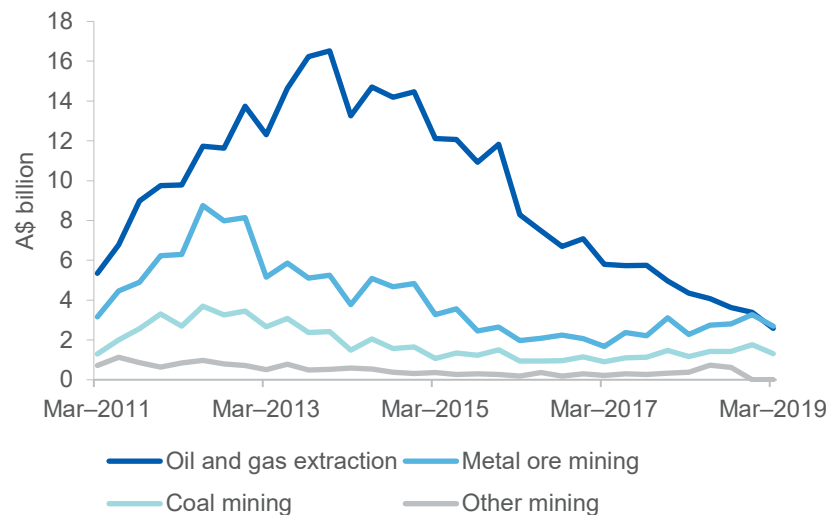
Source: Department of Industry, Innovation and Science (2019), ABS (2019)

Mining investment is recovering after years of decline

Investment in Australia's mining industry fell sharply in the March quarter, retreating by almost 20 per cent from the December quarter level. Falls were recorded for coal, gas and metal mining (Figure 1.7).

Over 2018–19 as a whole, investment is expected to have fallen to \$24.7 billion — continuing a long cycle of declines from 2012–13 (see Figure 1.8). However, at this stage, provisional indications are that investment is hitting the lowest part of the cycle and mining investment could rise to around \$32 billion in 2019–20. While this is not locked in, it does suggest that sentiment has begun to turn, amidst high growth in iron ore export earnings, strong metallurgical coal prices and promising prospects for critical commodities such as lithium.

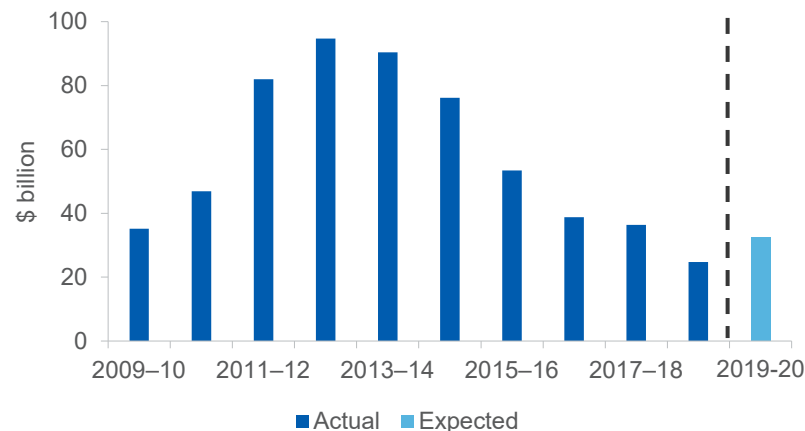
Figure 1.7: Mining industry capital expenditure by commodity



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 (2019) Private New Capital Expenditure and Expected Expenditure, 5625.0

Figure 1.8: Mining industry capital expenditure, fiscal year



Notes: Chart data is in nominal terms

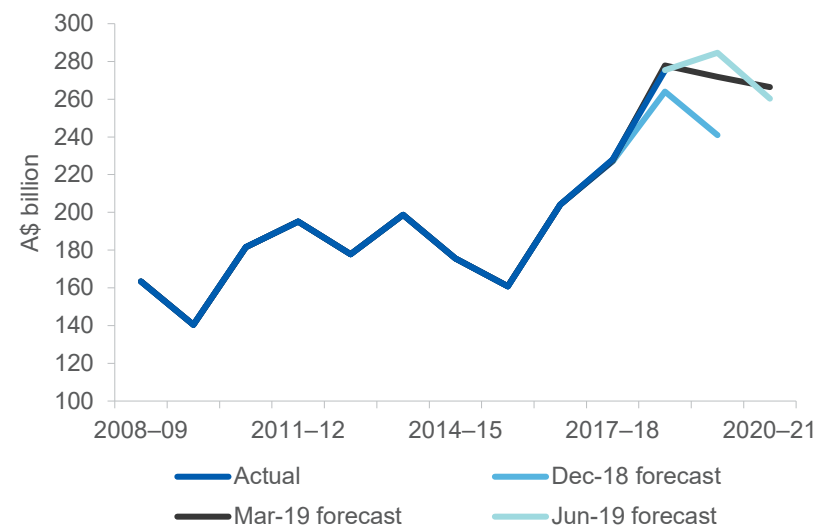
Source: ABS (2019) Private New Capital Expenditure and Expected Expenditure, 5625.0

1.7 Revisions to the outlook

At \$275 billion, the estimate for Australia's resources and energy export earnings in 2018–19 is down slightly from the \$278 billion estimate in the March 2019 *Resources and Energy Quarterly*. However, we now expect 2019–20 to set a fresh record, largely as a result of a stronger than expected iron ore price and the modestly weaker AUD/USD exchange rate than in our March forecasts. Those two factors accounted for the majority of the \$12.9 billion of the upward revision to total resource and energy exports forecast to amount to \$285 billion in 2019–20.

In 2020–21, stronger metallurgical coal export revenues — deriving from upward revisions to prices — will be more than offset by downward revisions to exports of thermal coal and copper, where prices are expected to be weaker than previously forecast. Export earnings are now forecast to be \$260 billion, down from \$266 billion forecast in the March 2019 REQ.

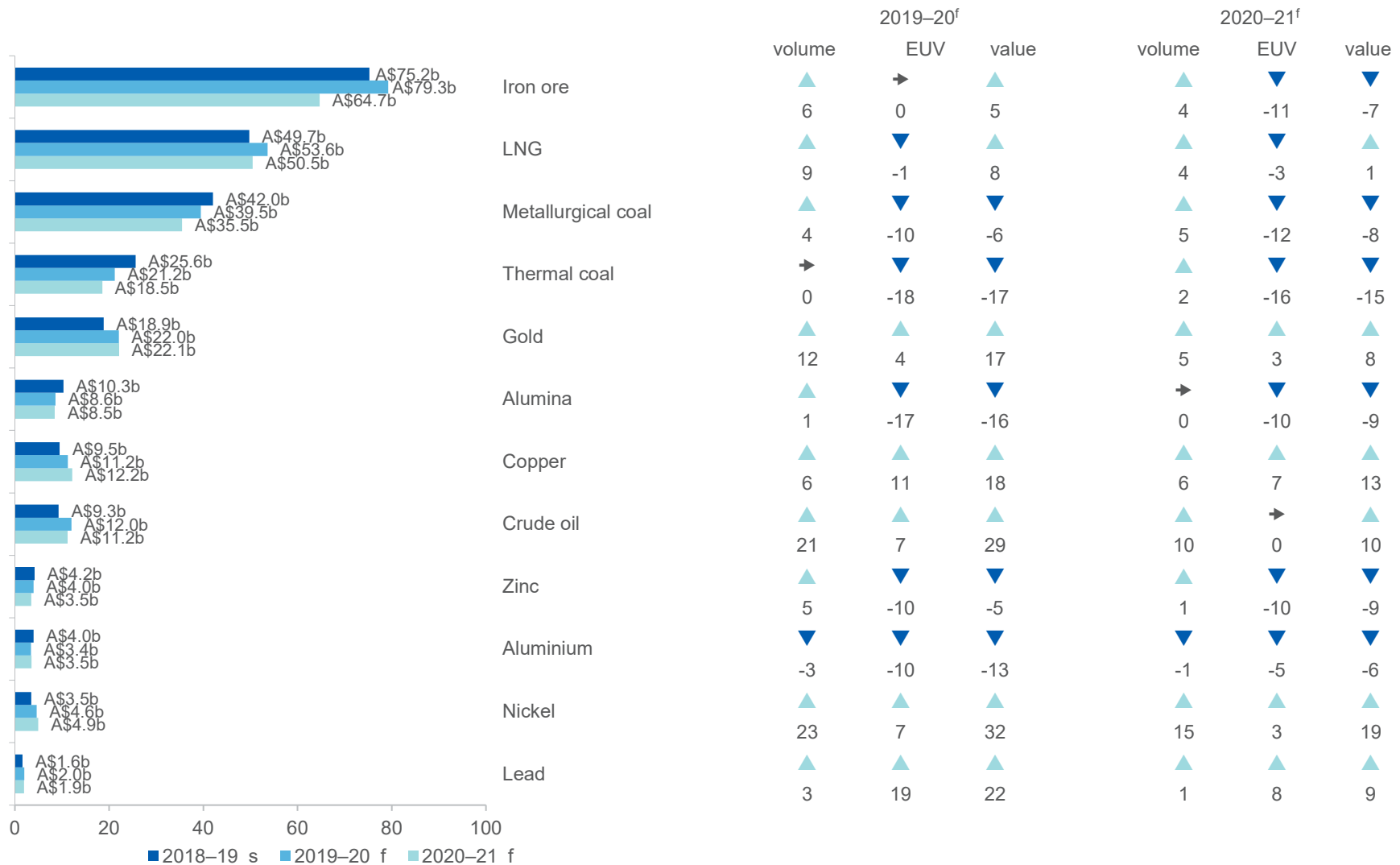
Figure 1.9: Revisions to the outlook



Notes: Chart data is in nominal terms

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

Figure 1.10: Australia's major resource & energy commodity exports



Notes: s estimate, f forecast.

Source: ABS (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019)

Table 1.1: Outlook for Australia's resources and energy exports in nominal and real terms

Exports (A\$m)	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	Annual percent change		
					2018–19 ^s	2019–20 ^f	2020–21 ^f
Resources and energy	228,027	275,294	284,588	260,920	20.7	3.4	–8.6
– real ^b	232,571	275,294	277,918	248,025	18.4	1.0	–10.8
Energy	101,958	131,102	132,207	121,217	28.6	0.8	–8.3
– real ^b	103,990	131,102	129,108	115,533	26.1	–1.5	–10.5
Resources	126,068	144,192	152,381	139,011	14.4	5.7	–8.8
– real ^b	128,581	144,192	148,810	132,492	12.1	3.2	–11.0

Notes: **b** In 2018–19 Australian dollars. **f** forecast. **s** estimate.

Source: ABS (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019)

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

	Unit	Prices			Unit	Export volumes			Export values, A\$b		
		2018–19 ^s	2019–20 ^f	2020–21 ^f		2018–19 ^s	2019–20 ^f	2020–21 ^f	2018–19 ^s	2019–20 ^f	2020–21 ^f
Iron ore	US\$/t	72	70	58	Mt	806	852	869	75	79	65
Metallurgical coal	US\$/t	205	182	163	Mt	180	188	198	42	39	36
LNG	A\$/GJ	12.6	12	12	Mt	75	81	81	50	54	50
Thermal coal	US\$/t	98	77	72	Mt	209	210	216	26	21	19
Gold	US\$/oz	1,266	1,361	1,413	t	329	370	363	19	22	22
Alumina	US\$/t	438	367	363	kt	17,684	17,803	17,839	10	8.6	8.5
Copper	US\$/t	6,203	7,103	7,553	kt	927	983	1,037	9.5	11	12
Oil ^a	US\$/bbl	69	74	70	kb/d	257	311	311	9.3	12	11
Aluminium	US\$/t	1,930	1,922	1,992	kt	1,410	1,362	1,373	4.0	3.4	3.5
Zinc	US\$/t	10,715	10,924	10,208	kt	1,437	1,510	1,457	4.2	4.0	3.5
Nickel	US\$/t	12,413	13,650	14,275	kt	221	271	291	3.5	4.6	4.9
Lithium	US\$/t	672	630	540	kt	1,376	1,545	1,638	1.3	1.5	1.4
Uranium	US\$/lb	27	31	36	t	6,857	7,240	6,500	0.6	0.7	0.6

Notes: **a** Export data covers both crude oil and condensate. **f** forecast. **Price information:** Iron ore fob (free-on-board) at 62 per cent iron content estimated netback from Western Australia to Qingdao China; Metallurgical coal premium hard coking coal fob East Coast Australia; Thermal coal fob Newcastle 6000 kc (calorific content); LNG fob Australia's export unit values; Gold LBMA PM; Alumina fob Australia; Copper LME cash; Crude oil Brent; Aluminum LME cash; Zinc LME cash; Nickel LME cash; Lithium spodumene ore. **s** estimate.

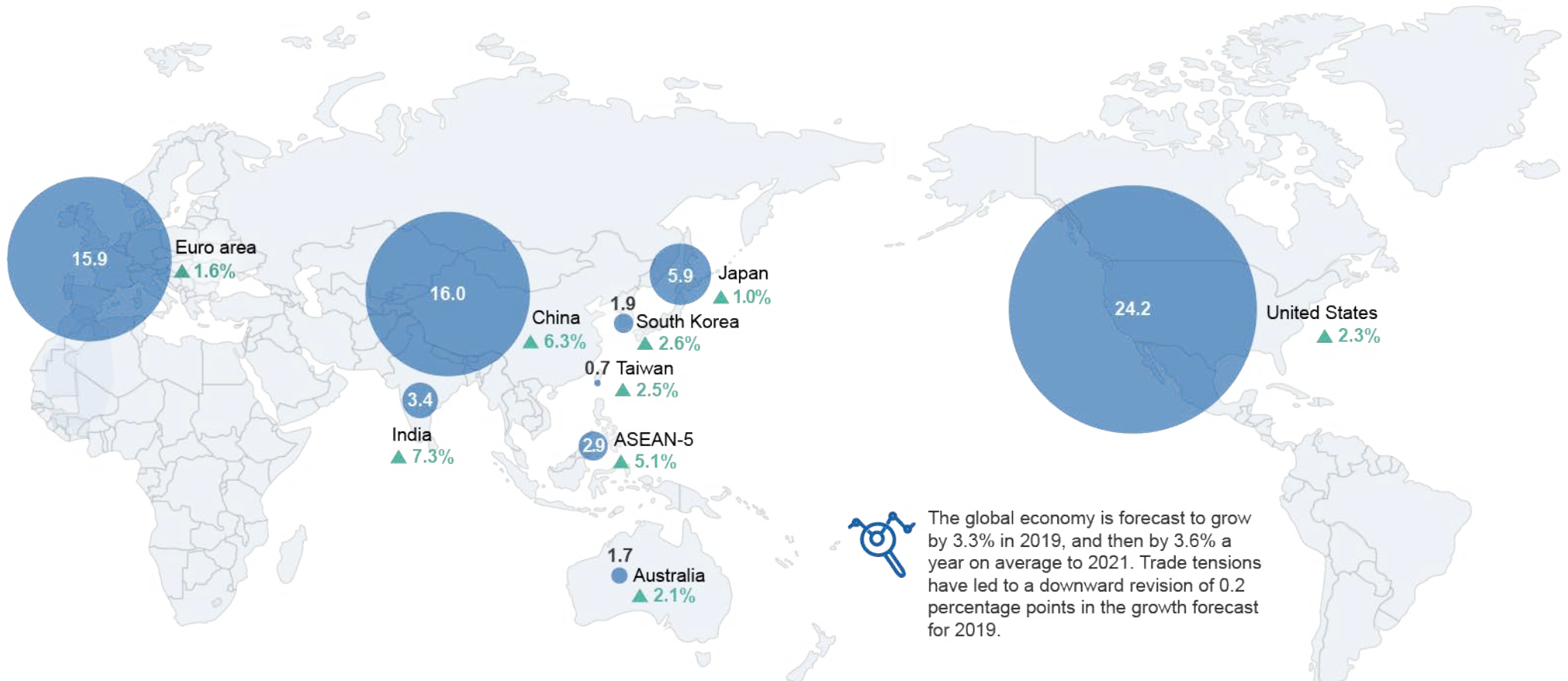
Source: ABS (2019) International Trade in Goods and Services, Australia, Cat. No. 5368.0; LME; London Bullion Market Association; The Ux Consulting Company; US Department of Energy; Metal Bulletin; Japan Ministry of Economy, Trade and Industry; Department of Industry, Innovation and Science (2019)

Macroeconomic Outlook

Resources and Energy Quarterly June 2019

● = Share of global GDP

▲ = Economic growth 2019



The global economy is forecast to grow by 3.3% in 2019, and then by 3.6% a year on average to 2021. Trade tensions have led to a downward revision of 0.2 percentage points in the growth forecast for 2019.

Risks — Trade tensions between the US and its trading partners, China's economic slowdown, Brexit uncertainty.

2.1 Summary

- The IMF forecasts global economic growth of 3.3 per cent in 2019, and by 3.6 per cent in 2020 and 2021. Global industrial production and trade figures declined in late 2018 and early 2019, but appear to be stabilising.
- Trade tensions between the US and China represent the largest risk to the outlook, with a resolution seemingly unlikely in the near future. Significant stimulus measures are being implemented in China in an attempt to offset the economic impacts of trade tensions.

2.2 Global economy

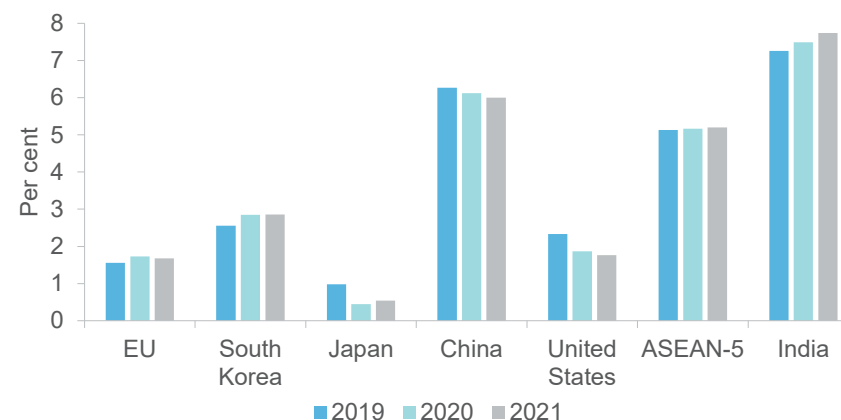
The global economy has grown for nine years without a recession, but risks and tensions are now rising. GDP growth is subject to a mixed and softening outlook among most countries (Figure 2.1).

The upsurge of trade tensions between the US and China presents the most significant risk to the global outlook. After China reversed its previous support for parts of a nascent trade agreement, the US announced in early May that tariffs on US\$200 billion of Chinese imports would be raised from 10 per cent to 25 per cent. China countered with penalties against \$US60 billion of imports from the US. The measures will affect a range of commodity-intensive technologies, including consumer goods, solar, wind and power storage technology, metals used in high-tech goods production, and materials used to store and transport natural gas.

Negotiations have so far spanned more than a year, and are currently stalled, with a number of contest points yet to be resolved. It is unclear whether any settlement will be reached in the near-term, amid increasingly bipartisan US support for a harder position against China. Global trade fell sharply at the end of 2018 as trade tensions intensified, before stabilising in mid-2019.

Chinese exports remain relatively solid overall, albeit with a sharp decline in sales to US markets. Overall exports from the US have also proven relatively resilient. In both cases, it appears that exporters are having some success in reaching alternative markets.

Figure 2.1: GDP forecasts



Source: International Monetary Fund (2019); Department of Industry, Innovation and Science (2019)

Figure 2.2: Global GDP and industrial production growth



Source: Markit (2019)

Trade tensions and a cyclical global slowdown have taken a toll on the global manufacturing Purchasing Managers Index (PMI), which fell to 49.8 in May 2019 as manufacturing activity contracted. This continues a slow decline from a peak of above 54 at the start of 2018 — with the pace of this decline picking up recently. Most countries have recorded significant downward movements in leading indicators of activity in recent months.

Global industrial production growth also eased, as trade difficulties added new uncertainties to global production chains (Figure 2.2). While some forecasters expect industrial production to recover in coming quarters, a potential escalation in trade tensions represents a significant risk.

Global demand for manufactured electronics has been hit particularly hard in recent months, and may now be moving into a downward cycle. Manufacturers in emerging Asia may be forced to wind back commodity imports as a result. Higher-value products, including batteries, may also be affected in the near future, though tariffs are yet to target these products.

Rare earth minerals, which are essential to many industrial and non-industrial applications, also remain exempt from US tariffs at present. Some media reports suggest that China — the largest supplier of rare earths — could cut off exports to the US and countries supplying US manufacturers. This may impact on manufacturing of a wide range of high-tech goods.

The US Administration has commenced a process examining the extension of tariffs to a further US\$300 billion per year of imports from China, which would effectively cover all remaining trade between the two countries.

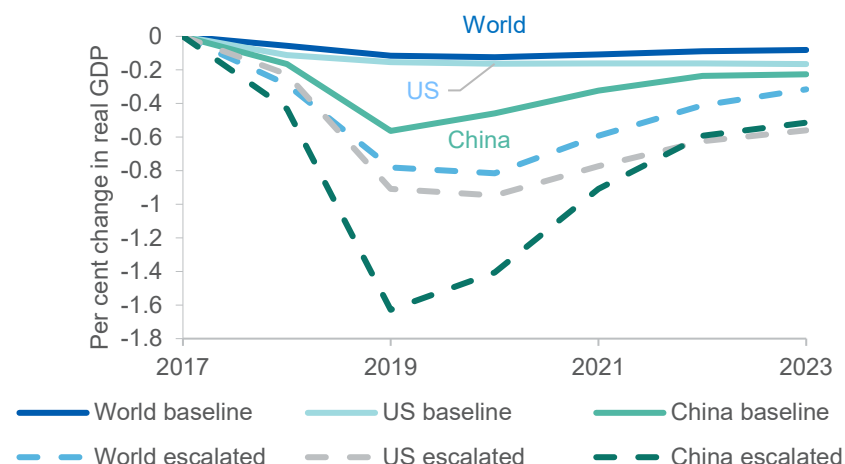
Trade tensions have led to series of economic stimulus measures in China. These include tax cuts worth almost US\$300 billion, with the bulk of the cuts targeting businesses. The People's Bank of China has cut bank reserve requirements, reducing financial costs for small and medium businesses. Chinese officials are seeking to fast-track large scale investment projects, and have allowed local governments to release more than US\$300 billion in bonds to fund new infrastructure. Also under

consideration are plans to stimulate the automotive sector and encourage more consumer spending. The effects of the stimulus measures are likely to rise steadily over time, peaking in 2019–20.

Consumption growth across OECD countries is holding up relatively strongly. Global labour markets remain tight, with wages growing faster in the US. Inflation remains contained in most countries, enabling central bankers to maintain stimulus. IMF projections suggest the impact of trade tensions could affect consumption more over time, especially as tariffs are now at the escalated level the IMF previously warned against (Figure 2.3).

Geopolitical problems are also adding to risk. Disputed territorial and maritime claims, combined with the ongoing militarisation of disputed features continue to be a source of tension in the South China Sea. The Middle East remains volatile, with heightened tensions involving the US and Iran, attacks on shipping in the Gulf, and ongoing conflict in Syria.

Figure 2.3: IMF projections on trade impacts



Source: IMF World Economic Outlook (2019). Implemented measures include \$50 billion of tariffs on steel, aluminium, solar panels and washing machines, \$50 billion and \$200 billion of tariffs that have already been imposed on Chinese imports. ** Escalated measures include \$267 billion of tariffs that is likely to impose on Chinese imports should the trade tensions escalate.

2.3 Country developments

The US economy seems relatively resistant to trade tensions — so far

Trade tensions and disruptions to export markets have affected production in the United States, with the US Performance of Manufacturing Index (PMI) falling from 52.6 in April 2019 to 50.5 in May 2019. Consumer spending has remained strong, and the unemployment rate has continued its nine-year decline, reaching 3.6 per cent in April.

Economic growth is projected to moderate over the outlook period, falling to 1.9 per cent by 2019 and 1.8 per cent by 2020. Much of the decline reflects the end of the fiscal boost from tax cuts, but recent downward revisions are largely a product of trade tensions. The recent lift in tariffs, and the uncertainty around a potential further escalation, may drag on consumer spending, with business investment now projected to fall marginally in 2019 and 2020.

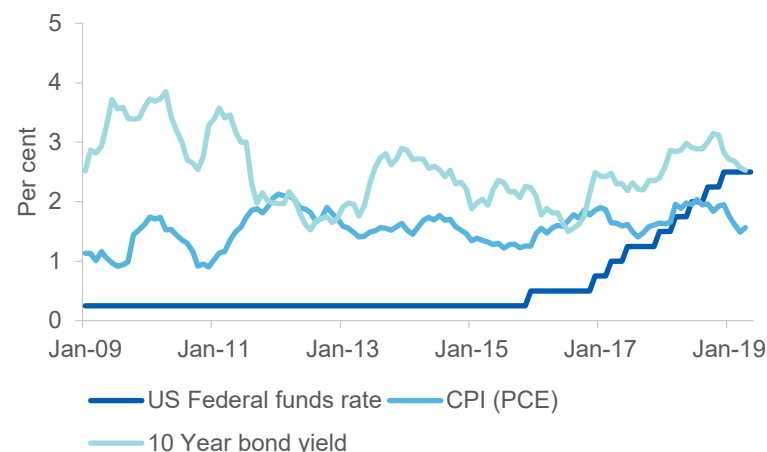
Further interest rate hikes are much less likely now as trade tensions rise. Any additional monetary stimulus is likely to drive a decline in bond yields and a relative depreciation of the US dollar. Ten year US Treasury yields have eased in recent months, falling from 2.71 per cent in March 2019, to 2.5 per cent by May, and just above 2.0 per cent in June (Figure 2.5).

Trade tensions are reinforcing a structural slowdown in Chinese growth

Revised figures suggest China's economic growth slowed to 6.6 per cent in 2018. Part of this slowdown reflects efforts by the government to reduce the environmental impact of economic activity. More stringent management of local government debt may also have constrained spending. However, US trade tensions have exacerbated these trends, leading to the lowest growth in China for almost 30 years.

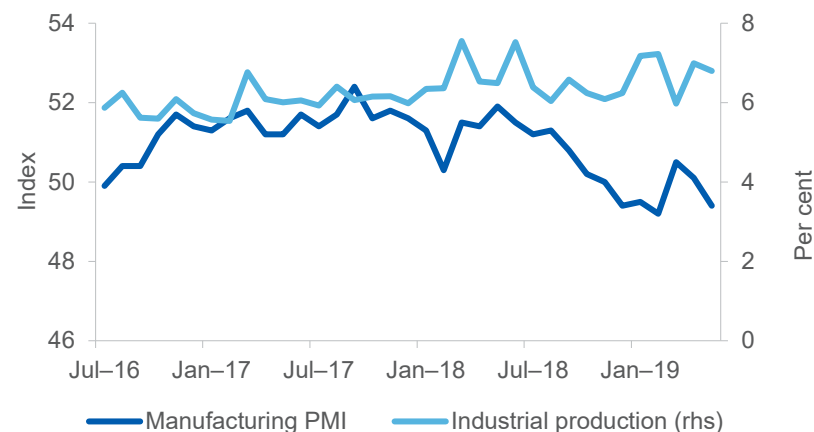
Chinese industrial production remains robust, rising by 6.8 per cent over the year to May (Figure 2.5). However, the PMI index, which is often seen as a forward indicator of manufacturing activity, suggests that activity is declining. Gradual offshoring of operations by manufacturers from

Figure 2.4: US Federal funds rate, CPI and 10-Year bond yield



Source: US Federal Reserve (2019) Federal Funds Rate; US Bureau of Labor Statistics (2019) US Personal Consumption Expenditure (PCE) Core Price Index

Figure 2.5: China's industrial production and Manufacturing PMI



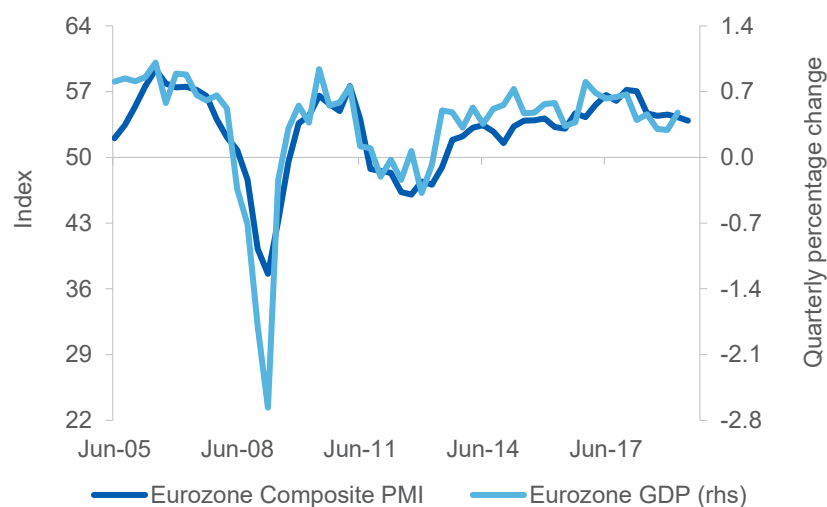
Source: Markit (2019); Netherland CPB (2019)

China to other South Asian countries (such as Vietnam) has been evident for some time, and US tariffs targeting China are likely to accelerate the pace of this trend. Chinese property markets appear to be oversupplied, affecting their ability to act as an offset to pressures elsewhere in the economy. The long-term transition towards a more consumer-driven Chinese economy is thus likely to become more important over time, with consumer spending increasingly essential to offset falls in net trade and investment. Chinese GDP growth is expected to continue easing slowly, reaching 6.0 per cent by 2021.

Europe faces sluggish growth and rising risks

Growth in the Eurozone economy in 2018 has been revised down to 2.1 per cent. This is well down from the 2017 level (2.7 per cent), and reflects rising problems among European economies, with a recession in Italy and rapid deceleration in France and Germany. Uncertainty over Brexit and contagion from the slowdown in China appear to be taking a toll. Leading indicators point to further weakening, with the manufacturing PMI

Figure 2.6: Eurozone Composite PMI and Real GDP



Source: Bloomberg (2019); International Monetary Fund (2019)

continuing to fall in mid 2019 (Figure 2.8).

Forecasts for economic growth in the Eurozone have been revised down, to only 1.6 per cent in 2019, and 1.7 per cent by 2021. Europe is likely to be weighed down by rising risks and soft performances in key economies.

Japan's GDP growth is likely to ease over the outlook period

Japan's economic growth in 2018 has been revised down to only 0.8 per cent as a result of weak consumer spending and weather disruptions. Japanese GDP is forecast to reach 1.0 per cent in 2019, before dropping to 0.5 per cent in 2020 and 2021. Labour shortages are constraining growth in some areas. Lower Chinese imports (linked to the US-China trade war) are also likely to affect net trade. Much of the decline is also linked to falling population: growth in GDP per capita is well above that of overall GDP over the outlook period.

South Korea faces mild constraints as a result of trade tensions

Like many other countries, South Korea's economic growth for 2018 has been revised down to 2.7 per cent, reflecting the impact of trade tensions late in the year. GDP fell marginally in the first quarter of 2019. Previous interest rate rises — intended to prevent capital flight to the US and cool the housing market — have dampened domestic demand slightly. Technology and advanced manufacturing exports to China have also weakened as the Chinese economy has slowed. Economic growth is projected to be pick up to 2.9 per cent by 2021, as Chinese demand recovers slightly.

India maintains one of the world's fastest economic growth rates

India's GDP grew by 7.1 per cent in 2018 — among the strongest growth rates in the world — as exports grew and reforms to simplify insolvency and bankruptcy laws took effect. Growth was slightly slower (5.8 per cent through the year) in the March quarter, but is expected to strengthen over time, aided by consumer spending, infrastructure development and new government guarantees around bank stability. Indian GDP is forecast to grow by 7.3 per cent in 2019, rising to 7.7 per cent by 2021.

Table 2.1: Key world macroeconomic assumptions

Per cent	2018	2019 ^a	2020 ^a	2021 ^a
Economic growth ^b				
Advanced economies	2.2	1.8	1.7	1.7
Australia	2.8	2.1	2.8	2.8
Eurozone	2.1	1.6	1.7	1.7
France	1.5	1.3	1.4	1.5
Germany	1.5	0.8	1.4	1.5
Japan	0.8	1.0	0.5	0.5
New Zealand	3.0	2.5	2.9	2.8
South Korea	2.7	2.6	2.8	2.9
United Kingdom	1.4	1.2	1.4	1.5
United States	2.9	2.3	1.9	1.8
Emerging economies	4.5	4.4	4.8	4.9
ASEAN-5 ^d	5.2	5.1	5.2	5.2
China ^e	6.6	6.3	6.1	6.0
Chinese Taipei	2.6	2.5	2.5	2.4
Emerging Asia	6.5	6.3	6.4	6.3
India	7.1	7.3	7.5	7.7
Latin America	1.0	1.4	2.4	2.6
Middle East	1.4	1.3	3.2	2.8
World^c	3.6	3.3	3.6	3.6

Notes: a Assumption; b Year-on-year change; 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 (2019) World Economic Outlook; Department of Industry, Innovation and Science (2019)

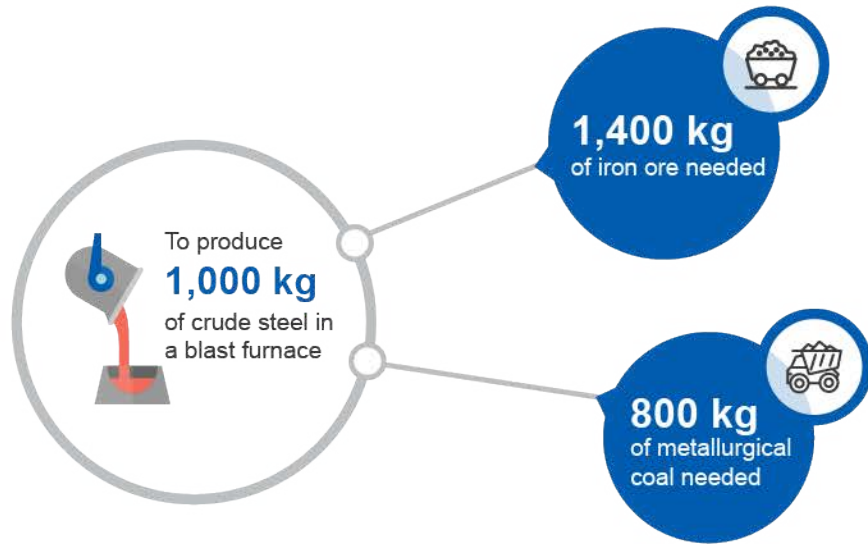
Table 2.2: Exchange rate and inflation assumptions

	2018	2019	2020	2021
AUD/USD exchange rate	0.78	0.72	0.72	0.75
Inflation rate				
United States	2.5	2.3	2.3	2.2
	2017–18	2018–19	2019–20	2020–21
Australia	1.9	2.0	2.4	2.5

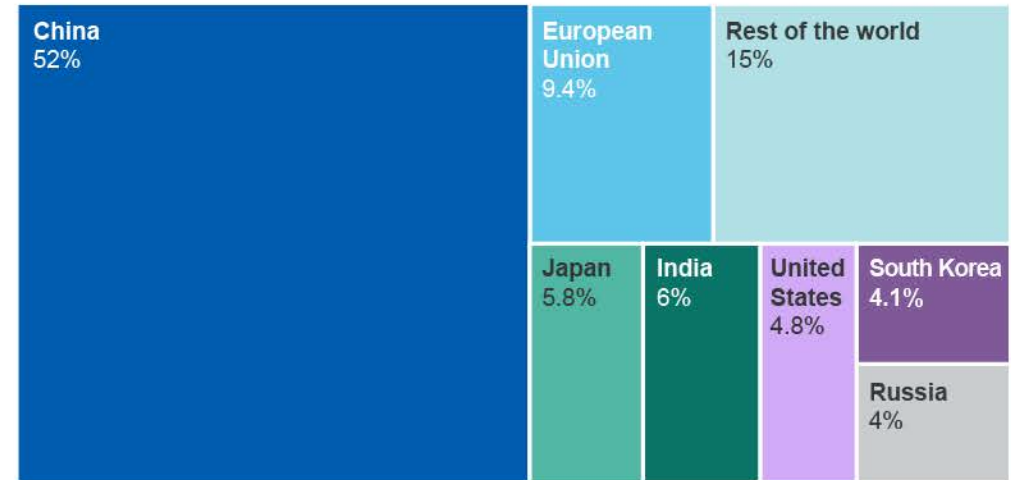
Notes: The inflation rate for Australia is used to convert Australian export values to real 2018–19 dollars.
The inflation rate for the United States is used to convert commodity prices denominated in USD to real 2019 dollars.
Source: Department of Industry, Innovation and Science (2019); Bloomberg (2019) Survey of economic forecasters

Steel

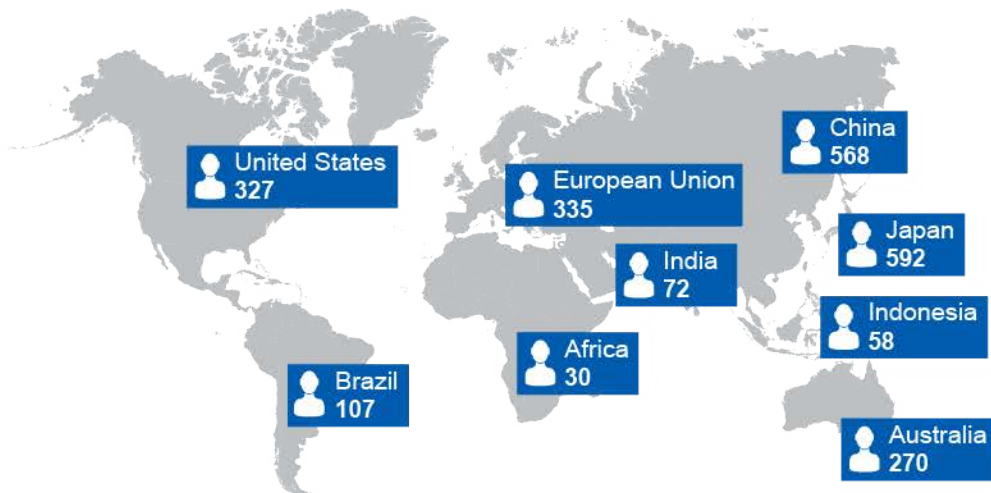
Resources and Energy Quarterly June 2019



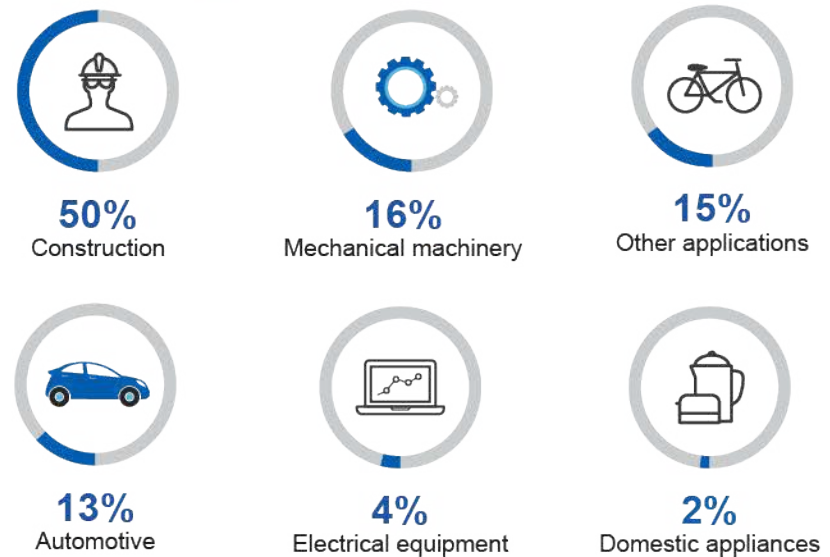
Major steel producers, 2018



Steel consumption per capita (kilograms per person), 2017



Steel use by sector



3.1 Summary

- World steel production is on track to set another record high in 2019, as robust production growth in China more than offsets subdued growth elsewhere.
- China's steel production and consumption is forecast to rise in 2019, fuelled by government tax cuts and stimulus directed towards steel-intensive infrastructure and construction projects.
- US-China trade tensions pose a risk to the outlook via the potential adverse impact on economic growth. Steel-intensive industries such as construction and manufacturing are sensitive to swings in economic growth.

3.2 World consumption and production

World steel production forecast to increase, but at a slower pace

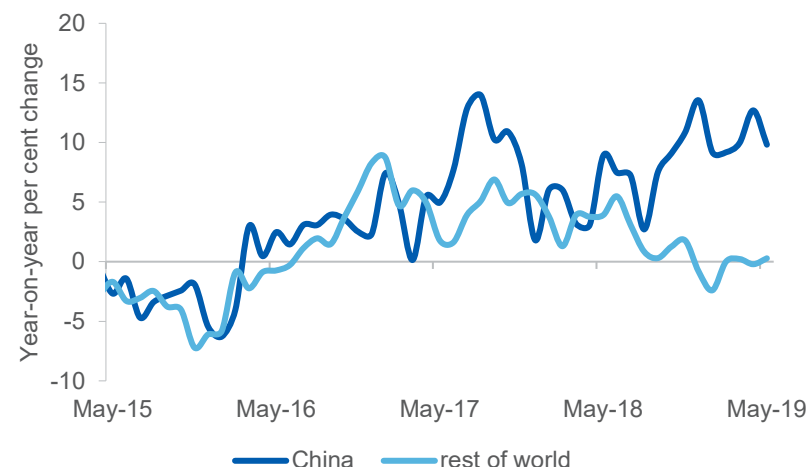
World steel production is estimated to have increased by 4.9 per cent year-on-year in the five months to May 2019. The solid growth has been driven by strong production in China — the world's largest steel maker, accounting for over half of world steel production — which has more than offset weaker steel production elsewhere (Figure 3.1). Production growth in China was driven by stimulatory government spending, which focused on higher infrastructure investment and boosting construction activity.

China's steel production boosted by high prices and strong demand

Chinese steel production increased by 10 per cent year-on-year in the five months to May 2019. Production has been buoyed by rising steel prices and profit margins (Figure 3.2), despite high iron ore and metallurgical coal prices. Government stimulus and the expanded use of special purpose bonds (mostly used to build infrastructure projects) increased domestic consumption. Despite three years of supply side reforms — which resulted in the closure of many inefficient and outdated steel mills — Chinese production has increased due to higher capacity utilisation rates.

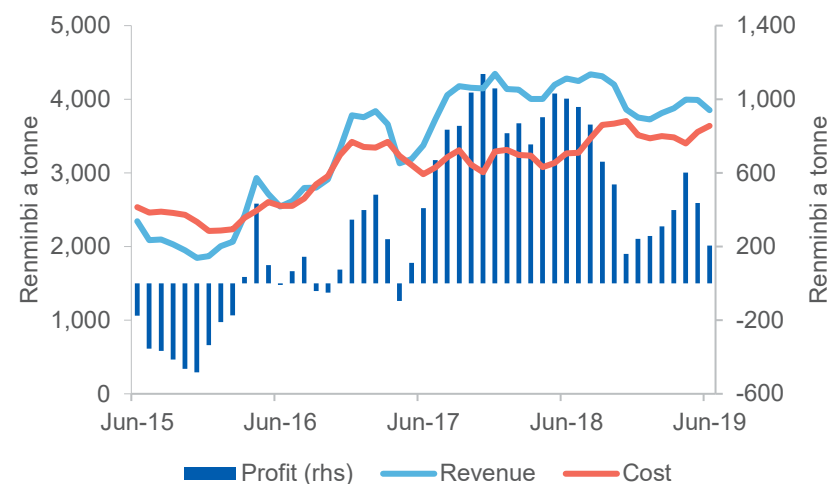
China's steel production is forecast to rise by 1.3 per cent to 940 million tonnes in 2019 — a new annual record. Government tax cuts and other stimulatory measures directed towards steel-intensive infrastructure and

Figure 3.1: Steel production growth in China and rest of world



Source: World Steel Association (2019); Bloomberg (2019)

Figure 3.2: Steel industry profits in China



Notes: Monthly average for integrated basic oxygen furnace (BOF) steel mills

Source: Bloomberg (2019) China BOF Steel Profit Index

construction projects, coupled with looser monetary conditions and good profit margins, are expected to boost steel production and consumption over the course of 2019.

China's steel production forecast to gradually decline

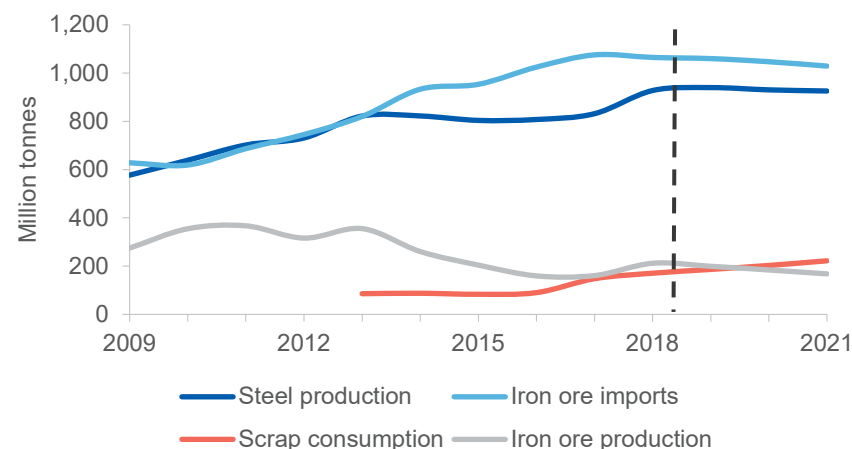
Steel production is forecast to taper lower at an annual average rate of 0.1 per cent, to 926 million tonnes in 2021 (Figures 3.3 and 3.4). Declining steel production is expected to be driven by a range of factors, including moderating consumption, the removal of government stimulus (which is expected to weigh on housing and infrastructure investment), more stringent environmental regulations, and further reductions in steel mill capacity — including the closure of Liuzhou Steel and Chanjiang Steel in 2021, together accounting for 16 million tonnes of capacity.

China is expected to increasingly use scrap material in steel production, which will diminish demand for imported iron ore and metallurgical coal (Figure 3.3). Higher scrap use will be driven by growing scrap availability, stemming from old construction works set to be demolished and replaced, and old machinery and autos having reached the end of their life span. Government tax incentives and high scrap prices are expected to rapidly bring additional domestic shredding capacity online, and increase the availability of scrap to steel mills over the outlook period. Higher domestic scrap supply will be partly offset by restrictions on imported scrap material.

China's steel exports decreased by 9.5 per cent in 2018 to 56 million tonnes, the lowest level in five years. Declining exports have been driven by strong domestic consumption, slowing global economic growth, and the implementation of trade barriers on steel and steel containing products into the US. China's exports are expected to be increasingly directed towards emerging markets in South East Asia, driven by growing demand from emerging economies.

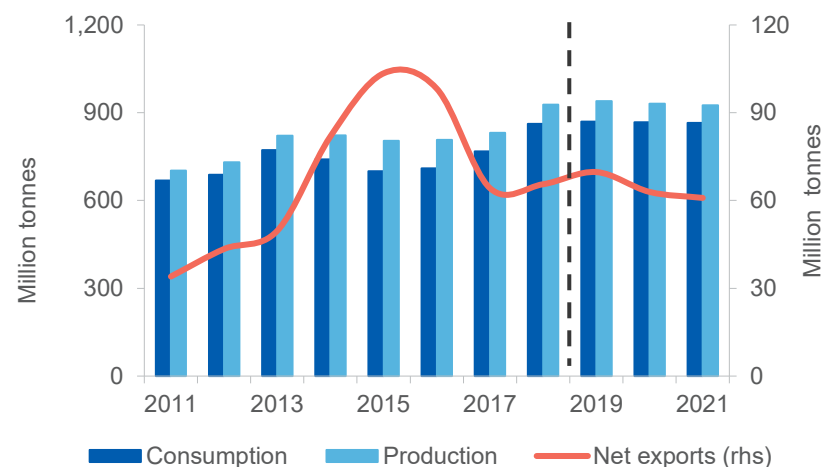
There is substantial uncertainty regarding the projections for China's steel sector. Government policy will continue to drive the outlook for steel, as authorities continue to adjust policies to manage a smooth transition while restructuring and reforming the economy.

Figure 3.3: Forecast for Chinese steel production and key inputs



Source: Bureau of International Recycling (2018) World Steel Recycling in Figures 2013–2017; Bloomberg (2019) World Steel Association; Department of Industry, Innovation and Science (2019)

Figure 3.4: China's steel consumption, production and exports



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

Emerging economies in Asia to increasingly drive steel demand growth

India overtook Japan to become the world's second largest steel producer in 2018 (Figure 3.5). However, 2019 started slower than expected, as the election process disrupted some infrastructure projects. India's steel production rose slightly at 1.1 per cent year-on-year in the five months to May 2019 to 45 million tonnes. Production is expected to ramp up over the remainder of 2019, driven by higher spending on infrastructure, with an estimated US\$63 billion set aside in the 2019–20 budget. India's steel production is forecast to increase at an annual average rate of 6.8 per cent to reach 130 million tonnes in 2021. Rising steel production will be driven by the ongoing expansion of steel-making capacity in line with national targets. India's National Steel Policy (2017) targets steel output capacity of 300 million tonnes and per capita steel consumption of 160 kilograms by 2030, up from 101 million tonnes and 75 kilograms per capita in 2017.

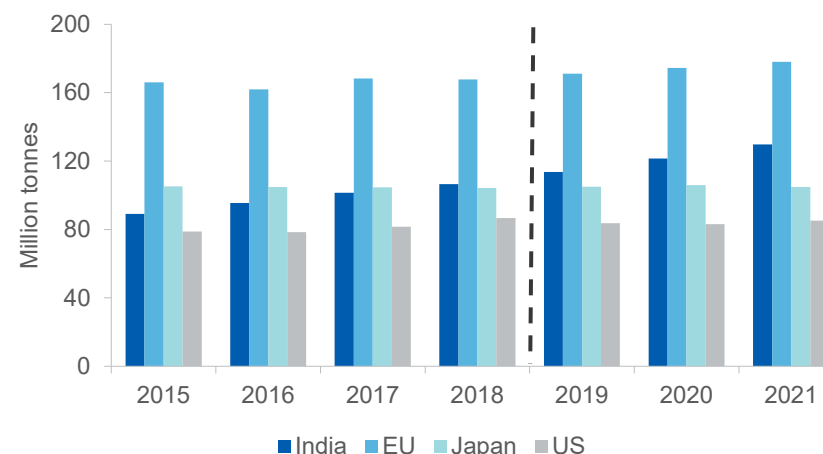
Emerging markets in Asia (excluding China) are forecast to edge past the EU by 2021, reaching 179 million tonnes as Vietnam and India rapidly expand their domestic steel industries.

Steel production mixed among key markets

In the five months to May, steel production in the EU and Japan declined by an estimated 2.2 and 4.4 per cent year-on-year, respectively. Production was weighed down by weaker manufacturing and industrial production. In contrast, US production increased 6.4 per cent year-on-year over the same period, benefiting from stronger industrial production and construction (Figure 3.6). The EU, Japan and US together account for 20 per cent of world production. Monetary conditions remain favourable in each region. However, the recent decline in production growth, in addition to declining manufacturing indices in each country or region, suggests that production will taper lower in 2019.

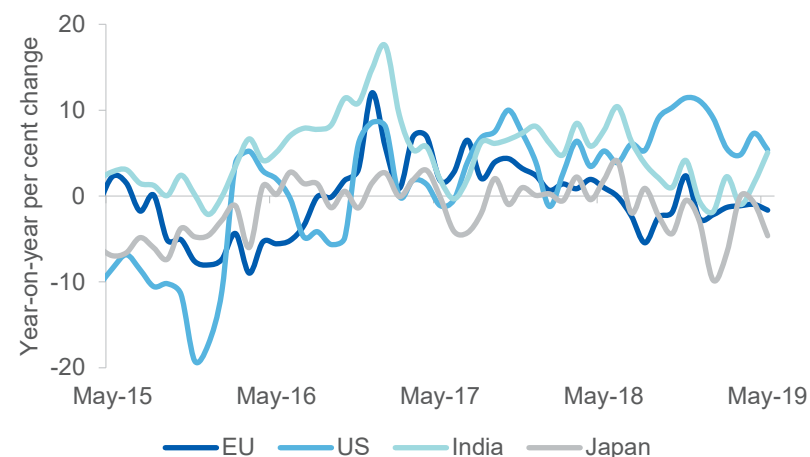
The growing array of trade protection measures among key nations is likely to weigh on investment decisions and economic growth, and subsequently dampen steel production and consumption.

Figure 3.5: Steel production by region



Source: World Steel Association (2019); Department of Industry, Innovation and Science (2019)

Figure 3.6: Steel production growth by region



Source: Bloomberg (2019) World Steel Association

Table 3.1: World steel consumption and production

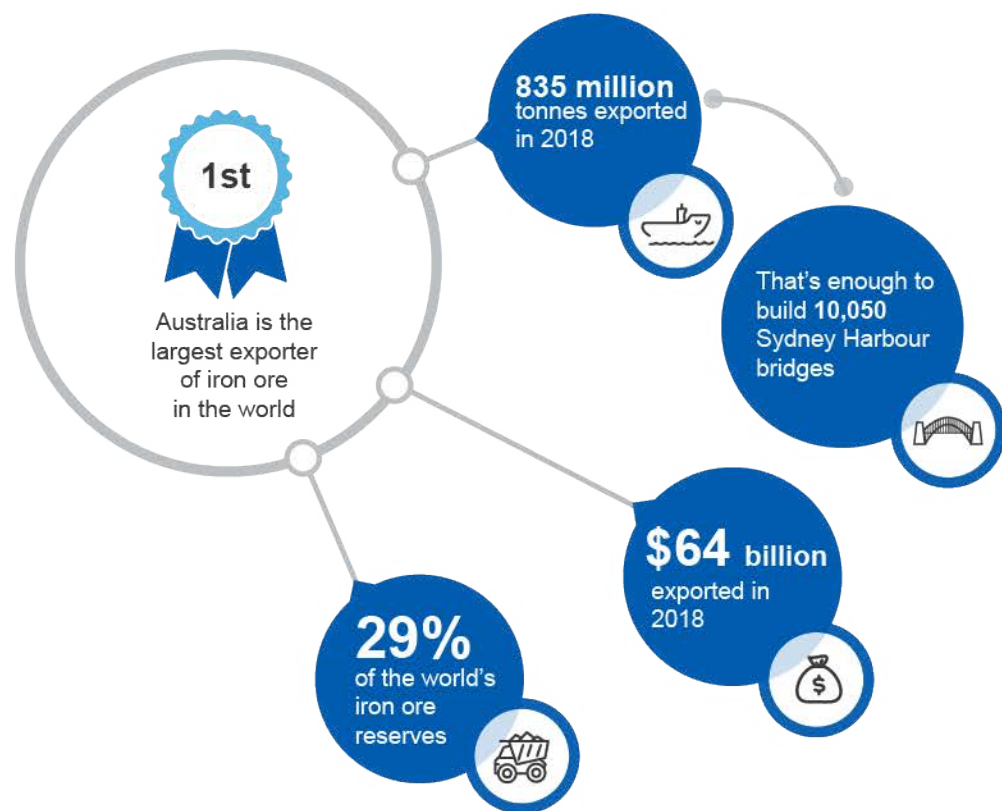
Crude steel consumption	Million tonnes				Annual percentage change		
	2018	2019 ^f	2020 ^f	2021 ^f	2019 ^f	2020 ^f	2021 ^f
China	862	870	867	865	0.9	-0.3	-0.3
European Union 28	175	174	174	180	-0.2	-0.2	3.3
United States	109	108	107	107	-1.0	-1.0	0.6
India	103	109	116	122	6.0	6.0	5.6
Japan	75	75	75	72	0.2	0.2	-3.9
Russia	59	59	59	59	-0.3	-0.4	-0.4
South Korea	42	42	42	42	0.3	0.0	-0.1
Brazil	23	23	23	24	1.7	1.5	1.5
World steel consumption	1,792	1,804	1,803	1,807	0.7	-0.1	0.2
Crude steel production	2018	2019 ^f	2020 ^f	2021 ^f	2019 ^f	2020 ^f	2021 ^f
China	928	940	930	926	1.3	-1.0	-0.5
European Union 28	168	171	175	178	2.0	2.0	2.0
India	106	114	121	130	6.8	6.8	6.8
Japan	104	105	106	105	0.7	0.9	-1.1
United States	87	84	83	85	-3.3	-0.8	2.6
Brazil	72	72	72	72	0.5	0.0	-0.1
Russia	72	71	70	70	-2.5	-0.4	-0.4
South Korea	35	34	34	35	-1.7	0.8	0.7
World steel production	1,788	1,805	1,806	1,808	1.0	0.0	0.1

Notes: ^f Forecast.

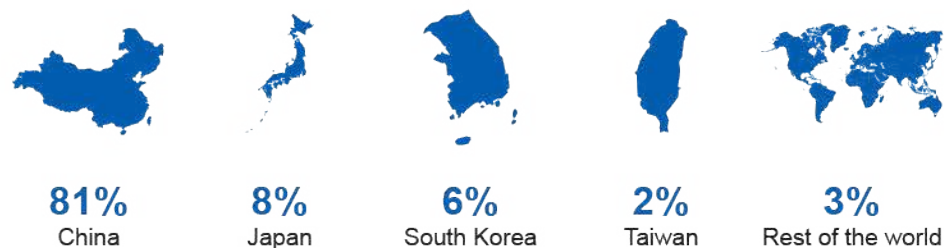
Source: World Steel Association (2019); Department of Industry, Innovation and Science (2019)

Iron Ore

Resources and Energy Quarterly June 2019

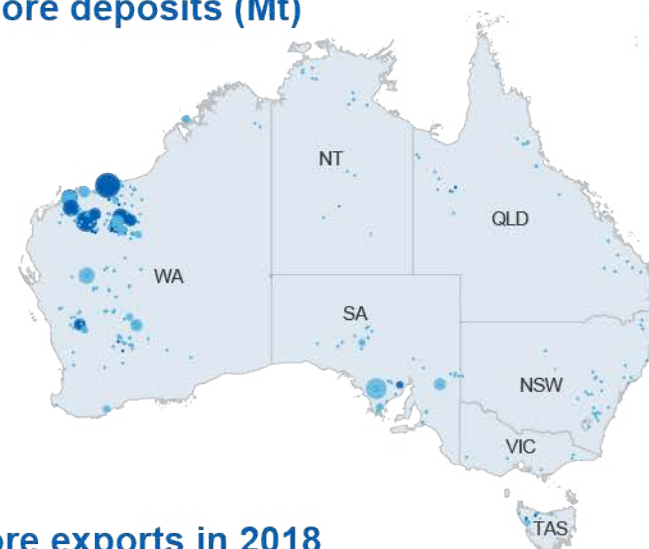


Australia's iron ore key export destinations, 2018

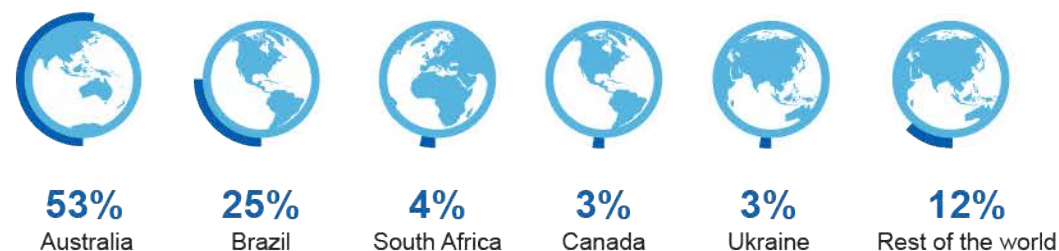


Major Australian iron ore deposits (Mt)

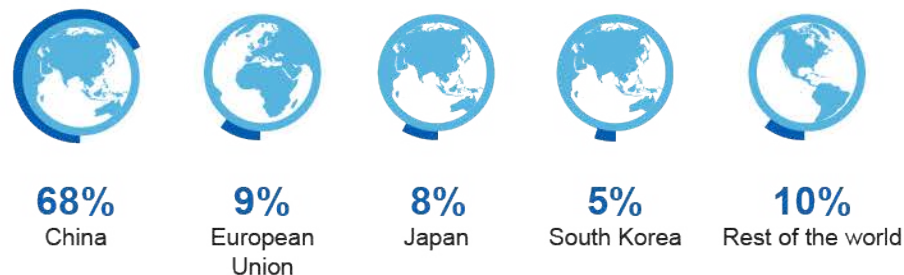
- <229
- 230–813
- 814–1,777
- 1,778–3,042
- 3,043–5,446
- >5,447
- Deposit
- Operating mine



Global share of iron ore exports in 2018



Global share of iron ore imports in 2018



4.1 Summary

- The forecast iron ore price in 2019 has been revised up to average US\$80 a tonne (Free on board (FOB) Australia), due to supply disruptions — primarily in Brazil — and robust demand from China. Australia's iron ore export earnings are set to increase from \$61 billion in 2017–18 to an estimated \$75 billion in 2018–19.
- The iron ore price is subsequently forecast to decline to average US\$57 a tonne (FOB Australia) in 2021, as the seaborne market returns to balance. Export earnings are forecast to decrease to \$65 billion by 2020–21, as a result of the forecast decline in prices.
- Australia's iron ore exports are forecast to rise from an estimated 806 million tonnes in 2018–19 to 869 million tonnes in 2020–21, driven by large-scale producers ramping up to long-term production targets.

4.2 Prices

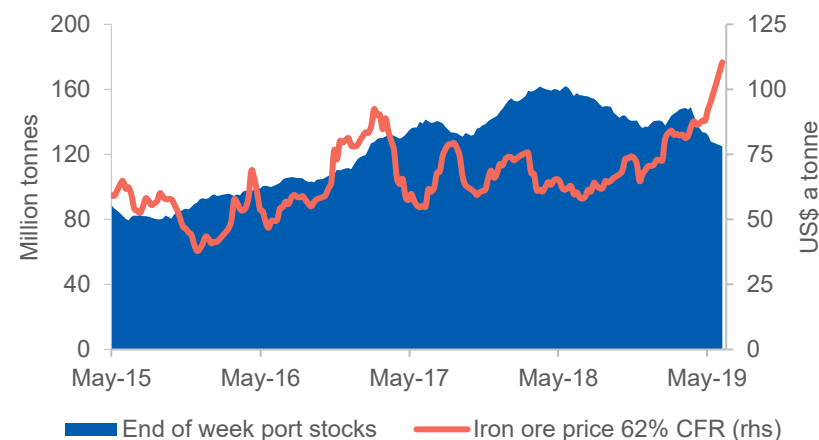
Iron ore prices surge after Brazilian tragedy shocks world supply

The FOB Australia iron ore price (62% iron content) — at which most Australian iron ore is sold — rose by 54 per cent year-on-year to average US\$88 a tonne in the June quarter of 2019, a five-year high, driven by both supply disruptions and robust steel production in China (Figure 4.1).

A decline in Vale's Brazilian production, stemming from their tragic tailings dam rupture in late January, had the largest impact on seaborne supply. Adverse weather also trimmed supply from operations in the northern region. Vale reports that 90 million tonnes of production has been sidelined since the collapse of the Brumadinho dam, and it will be two to three years before they can produce at their pre-dam rupture target of 400 million tonnes. Cyclone Veronica also temporarily disrupted Australian exports in late March, adding to tightness in global seaborne supply.

The supply issues helped drive China's iron ore port stocks down by 17 per cent year-on-year in the month of May 2019. China imports around 70 per cent of world seaborne supply, and port stocks are an important indicator of market balance — the rapid decline in stocks reflected a tighter market and drove prices higher.

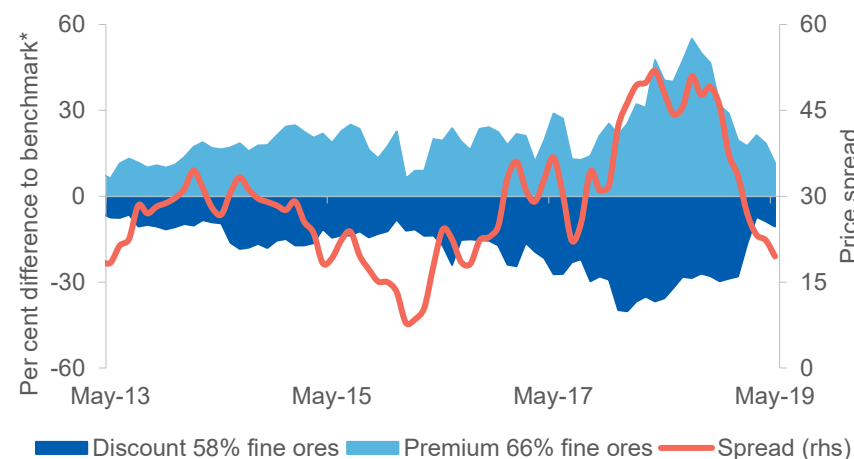
Figure 4.1: China's iron ore port stocks and spot price



Notes: China import iron ore fines 62% Fe spot (CFR Tianjin port)

Source: Bloomberg (2019) Antaika iron ore port stocks and Metal Bulletin

Figure 4.2: Iron ore price spread between grades



Notes: *Benchmark used is 62 per cent iron fines CFR

Source: Bloomberg (2019) China import prices

On the demand side, China's steel production continues to grow, driven by healthy profit margins and rising steel prices. Nonetheless, the high price and exceptionally tight supply of high grade iron ore (65% Fe content), have incentivised Chinese steel makers to use lower grade ores, which has led to a reduction in the price spread between high (66% Fe) and low (52% Fe) grade iron ores (Figure 4.3).

Prices forecast for short term strength before moderating

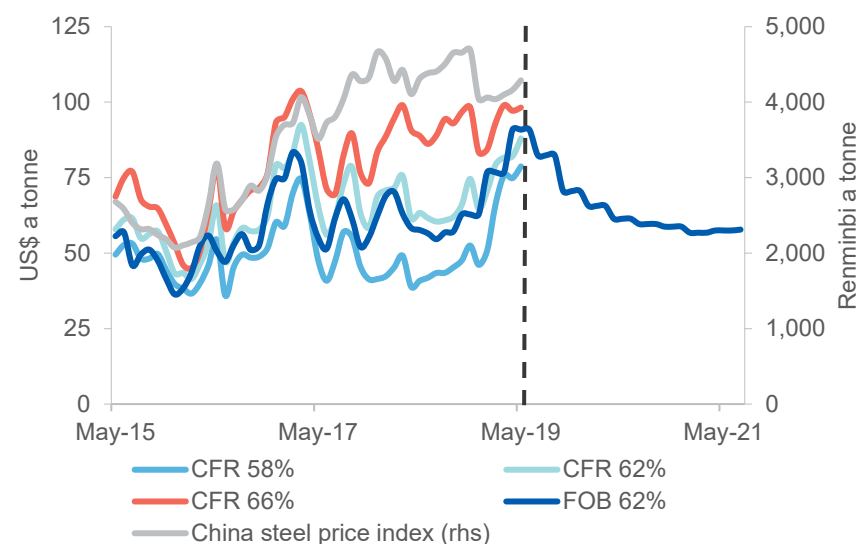
The iron ore price is forecast to increase by 29 per cent year-on-year to average US\$80 a tonne in 2019 (FOB), largely due to the dramatic cut in supply in the aftermath of the Brazilian dam collapse (Figure 4.3). Most of the recovery in Vale's production is expected to take two to three years, and will occur towards the end of the outlook period. However, 30 million tonnes stemming from the court ordered closure of Brucutu was granted regulatory approval to restart on 19 June 2019.

An expected slowdown in global economic growth in 2019 and 2020 is a key risk to the outlook, and will likely lead to less demand for steel-making inputs — metallurgical coal and iron ore. However, China (accounting for half of world steel production) is expected to respond to slowing growth and US-China trade tensions by loosening monetary policy and increasing government spending on (steel-intensive) infrastructure and construction projects.

The Chinese government's capacity to stimulate the economy could more than offset weaker demand elsewhere and thus flow through to higher iron ore and metallurgical coal prices (Figure 4.4). Much depends on the response of Chinese steel and iron ore producers: Chinese steel producers will attempt to use more scrap material, thus displacing iron ore in steel production. Chinese iron ore producers will expand production and re-open operations, in an attempt to reduce imports.

The iron ore price is forecast to decline to average US\$57 a tonne in 2021, as Vale's production recovers and as moderating consumption weighs on China's demand, returning the seaborne market to surplus.

Figure 4.3: Iron ore price by grade and China steel price index



Notes: The OCE forecasts the FOB (free on board) Australia iron ore price, not the benchmark CFR (cost and freight) North China iron ore price.

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

Figure 4.4: Iron ore price and China steel production growth



Notes: China import Iron ore fines 62% Fe spot (CFR Tianjin port)

Source: Bloomberg (2019) China import prices; World Steel Association (2019)

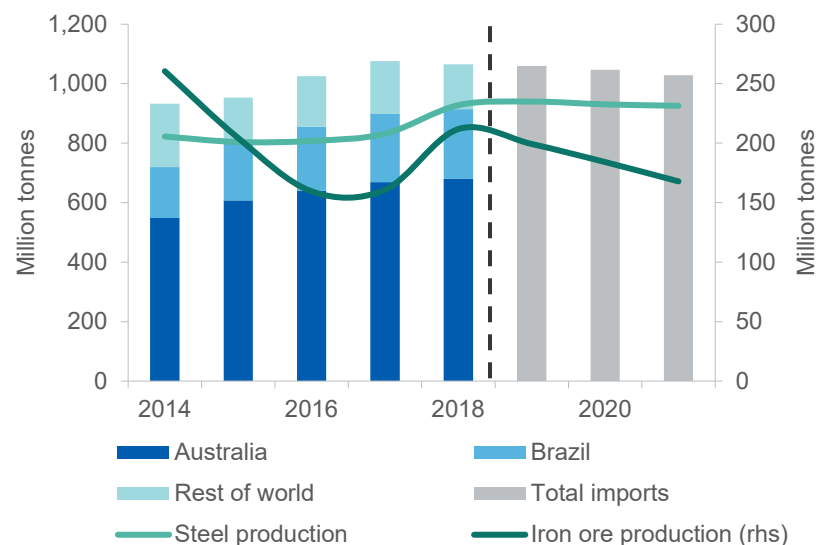
4.3 World trade

China's iron ore imports forecast to gradually decline

China's iron ore imports declined by 4.9 per cent year-on-year in the five months to May, to 425 million tonnes, despite record high steel production. The decline in imports of iron ore to China — which accounts for roughly 70 per cent of imported seaborne supply — reflects both the supply disruptions stemming from Brazil and, to a lesser extent, Australia, but also higher domestic iron ore production and the rising use of scrap material — which is displacing some iron ore use.

China's iron ore imports peaked at 1,075 million tonnes in 2017, and are forecast to decline over the outlook period — down to 1,029 million tonnes in 2021 (Figure 4.5) — driven by an expected decline in steel output and rising scrap use (see the *steel* chapter).

Figure 4.5: China's iron ore imports and production



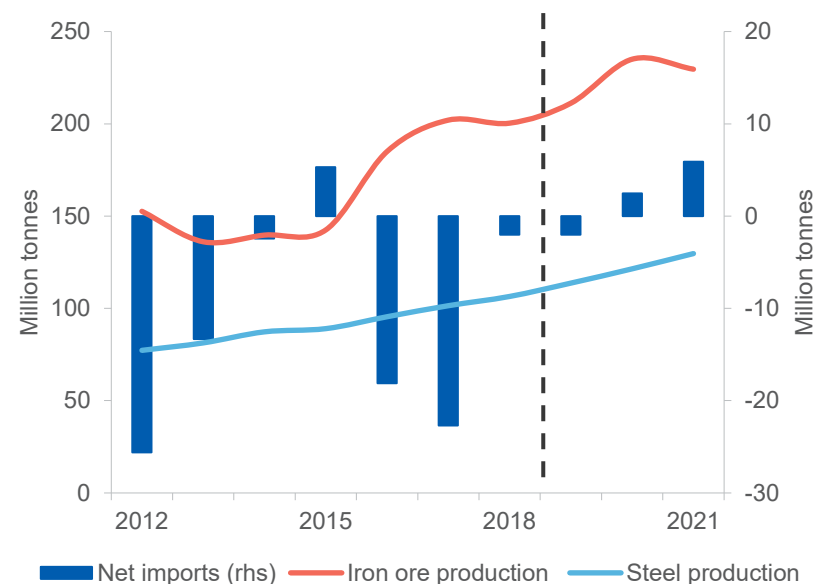
Notes: China's iron ore production is quality adjusted. 2018 import figures are estimates.
Source: Bloomberg (2019) Antaike Information Development; Bloomberg (2019) China Customs General administration; Department of Industry, Innovation and Science (2019)

India set to become a net importer of iron ore

India's iron ore production is forecast to increase by 4.6 per cent annually, from an estimated 200 million tonnes in 2018 to 230 million tonnes in 2021. Rising iron ore production will be driven by rapidly growing demand from the domestic steel industry. However, ongoing challenges in accessing land and capital, insufficient infrastructure to transport ore, complex regulations and community objections, are likely to hinder the development of new mines over the outlook period.

India is forecast to become a small net importer of iron ore from 2020 onwards, as the government pursues ambitious steel production targets, but tightly regulates the domestic iron ore industry and continues to clamp down on illegal iron ore mines (Figure 4.6).

Figure 4.6: India's iron ore imports and domestic production



Source: World Steel Association (2019); Department of Industry, Innovation and Science (2019)

Brazilian supply shock to dampen export growth in the short-term

Global seaborne iron ore supply is forecast to decline by 4.1 per cent to around 1,530 million tonnes in 2019, driven by events stemming from the Vale dam collapse in Brazil in late January (Figure 4.7).

Vale's production is expected to gradually recover over the next three years, steadily moving towards the 400 million tonne target it set before the Brumadinho tailings dam collapse. In the meantime, the supply of high grade (65% Fe content) iron ore will be limited, only improving with the ramp up of Vale's S11D project at the Carajás complex, and the restart of their Brucutu operations.

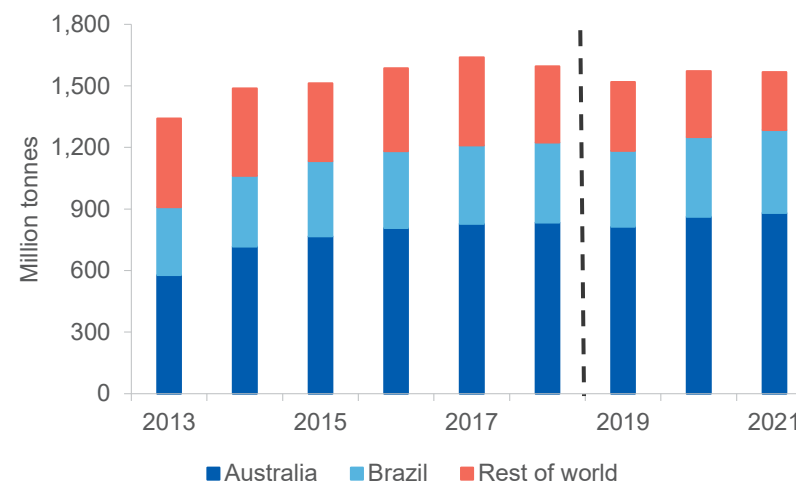
The full recovery in Vale's production hinges upon 60 million tonnes of production associated with the use of tailings dams. Of this amount, 30 million tonnes is expected to come back on line if Vale can successfully convert these mines over from wet processing — which relies on water to remove impurities from run-of-mine ores — to dry processing, which does not require the use of tailings dams.

Vale will also need to prove to government authorities that the subsequent use of blasting will not impact the stability of associated tailings dams (otherwise it is unlikely they will be granted permission to restart).

The other 30 million tonnes involves operations which are expected to continue using wet processing and tailings dams. The restart of wet processing — expected to take two to three years — requires Vale to prove to authorities that the tailings dams are safe to operate, and in some cases, undertake various measures to strengthen existing dam structures.

Elsewhere in Brazil, Anglo American's Minas-Rio continues to ramp up towards nameplate capacity of 26 million tonnes, producing 4.9 million tonnes of high grade iron ore in the March quarter 2019. Vale's high grade Samarco mine — closed since the tailings dam burst in November 2015 — is expected to return to production by 2020, with output gradually ramping up to nameplate capacity of 32 million tonnes.

Figure 4.7: Outlook for global iron ore exports



Source: World Steel Association (2019); Department of Industry, Innovation and Science (2019)

Supply elsewhere to gradually help ease the market deficit

Australia, the world's largest producer of iron ore, is forecast to increase production from 2020 onwards — but has limited capacity to ramp up in 2019 and was adversely impacted by Cyclone Veronica (Section 4.4).

Two projects in the Democratic Republic of Congo are set to ramp up over the outlook period: the Sapro group recently delivered its first shipment of high grade (65% Fe) iron ore to China, and is expected to ramp up to 12 million tonnes by 2022; and the Glencore and Zanga joint venture is expected to supply 2 million tonnes of high grade iron ore over 2019 and 2020.

Tacora's Wabush high grade iron ore mine in Canada is on track to restart in June and gradually ramp up to 6 million tonnes.

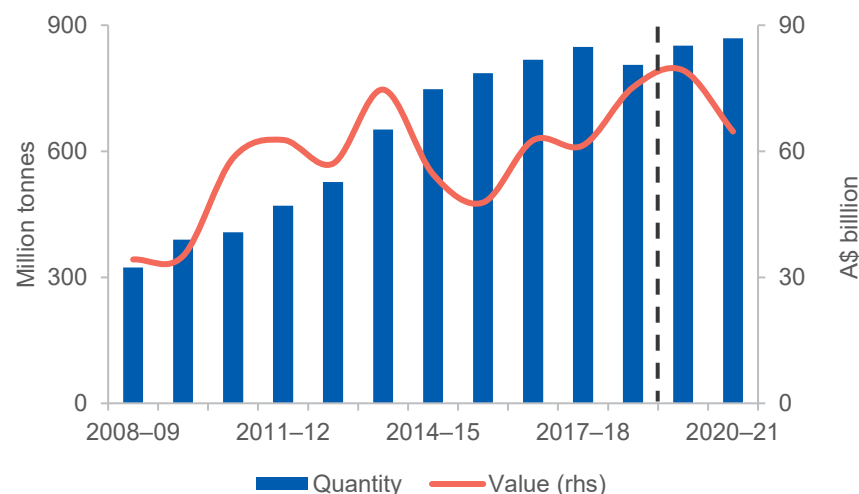
4.4 Australia

Australia's iron ore export earnings boosted by higher prices

Australia's iron ore export earnings are estimated to have increased by 23 per cent to \$75 billion in 2018–19, the second highest level on record (Figure 4.8). Export earnings benefited from rising prices, which more than offset the impact of lower volumes — which were adversely impacted by weather related events in the first half of 2019. Australian producers also benefited from a relatively low exchange rate, as well as a narrowing in the price spread between high and low grade ores — as Chinese steel makers substituted low grade ores to mitigate the loss of Vale's high grade supply.

Export values are forecast to rise to \$79 billion in 2019–20, driven by elevated prices and export volumes, before declining to \$65 billion in 2020–21. Driving the decline will be falling prices, as the seaborne market returns to a more balanced position from the second half of 2020 onwards.

Figure 4.8: Australia's iron ore export volumes and values



Source: ABS (2019) International Trade, Australia, 5368.0; Department of Industry, Innovation and Science (2019)

Australia's iron ore export volumes forecast to grow

Australia's iron ore export volumes declined by 5.2 per cent year-on-year in the March quarter to 188 million tonnes, primarily driven by the impact of Cyclone Veronica in late March — which disrupted port operations in the Pilbara region.

Export volumes are forecast to increase by an annual average of 3.9 per cent over the outlook period, from 806 million tonnes in 2018–19 to 869 million tonnes in 2020–21. Higher volumes will be underpinned by the development of three of the world's largest iron ore projects, namely: Fortescue's Eliwana, set to commence in December 2020 and produce 30 million tonnes per year; Rio Tinto's Koodaideri, expected to commence in late 2021 and produce 43 million tonnes per year; and BHP's South Flank, set to produce 80 million tonnes annually and replace existing production from the Yandi operations in 2021.

Revisions to export earnings

The forecasts for Australia's iron ore export earnings in 2019–20 has been revised up by \$12.5 billion, reflecting an upwards adjustment to the iron ore price in the wake of the Brumadinho tailings dam collapse on 25 January 2019 and robust steel production in China. The iron ore price is expected to be higher than previously forecast — and for a longer period — due to the limited capacity of other operations in Australia and elsewhere to ramp up and replace Vale's production loss of high grade supply, at least in the short term.

Iron ore exploration expenditure expected to rise over the outlook

Australia's iron ore exploration expenditure increased by 18 per cent year-on-year to \$59 million in the March quarter 2019 — the strongest growth since 2012. Iron ore exploration expenditure has picked up due to the strong surge in prices and is expected to increase over the outlook period. Strong demand for high grade iron ore — driven by Chinese steel makers' efforts to improve productivity and manage carbon emissions — is likely to support future exploration targeted at finding high grade iron ore reserves.

Table 4.1: World trade in iron ore

	Million tonnes				Annual percentage change		
	2018	2019 ^f	2020 ^f	2021 ^f	2019 ^f	2020 ^f	2021 ^f
Total world trade	1,595	1,529	1,570	1,568	-4.2	2.7	-0.2
Iron ore imports							
China	1,065	1,060	1,047	1,029	-0.4	-1.2	-1.7
European Union 28	148	150	152	153	1.4	1.4	0.2
Japan	129	130	131	129	0.5	0.7	-1.1
South Korea	73	76	75	75	3.0	-0.4	-0.4
India	16	12	15	17	-24.5	20.8	14.6
Iron ore exports							
Australia	835	814	862	881	-2.5	6.0	2.2
Brazil	390	370	388	403	-5.0	4.9	3.8
Ukraine	35	30	29	30	-14.3	-3.3	1.7
India	18	14	12	11	-21.6	-14.1	-11.1

Notes: ^f Forecast.

Source: World Steel Association (2019); International Trade Centre (2019); Department of Industry, Innovation and Science (2019)

Table 4.2: Iron ore outlook

Annual percentage change								
World	Unit	2018	2019 ^f	2020 ^f	2021 ^f	2019 ^f	2020 ^f	2021 ^f
Prices ^{bc}								
– nominal	US\$/t	61.2	80.1	61.4	57.5	30.9	-23.4	-6.3
– real ^d	US\$/t	62.6	80.1	60.0	55.0	28.0	-25.2	-8.3
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2018–19 ^s	2019–20 ^f	2020–21 ^f
Production								
– Steel ^{hs}	Mt	5.71	5.78	5.78	5.79	1.2	0.0	0.2
– Iron ore	Mt	900	890	903	912	-1.1	1.5	1.0
Exports								
Steel	Mt	1.15	0.90	0.99	1.00	-21.4	9.8	0.2
– nominal value	A\$m	926	949	751	752	2.4	-20.9	0.2
– real value ^{hi}	A\$m	945	949	733	717	0.4	-22.7	-2.2
Iron ore	Mt	848	806	852	869	-5.0	5.7	2.0
– nominal value	A\$m	61,392	75,233	79,266	64,691	22.5	5.4	-18.4
– real value ⁱ	A\$m	62,616	75,233	77,408	61,657	20.2	2.9	-20.3

Notes: **b** fob Australian basis; **c** Spot price, 62 per cent iron content basis; **d** In 2019 US dollars; **f** Forecast; **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 2018–19 Australian dollars; **s** Estimate.

Source: ABS (2019) International Trade in Goods and Services, Australia, 5368.0; Bloomberg (2019) Metal Bulletin; World Steel Association (2019); AME Group (2019); Company Reports; Department of Industry, Innovation and Science (2019)

Metallurgical Coal

Resources and Energy Quarterly June 2019

Australia is the largest exporter of metallurgical coal



Every tonne of steel produced needs about **800kg** of metallurgical coal.



Metallurgical coal is a non-substitutable raw material in the production of steel from iron ore.

Australia accounted for around



17% of world production in 2017

It takes more than **200 tonnes** of metallurgical coal to make every wind turbine

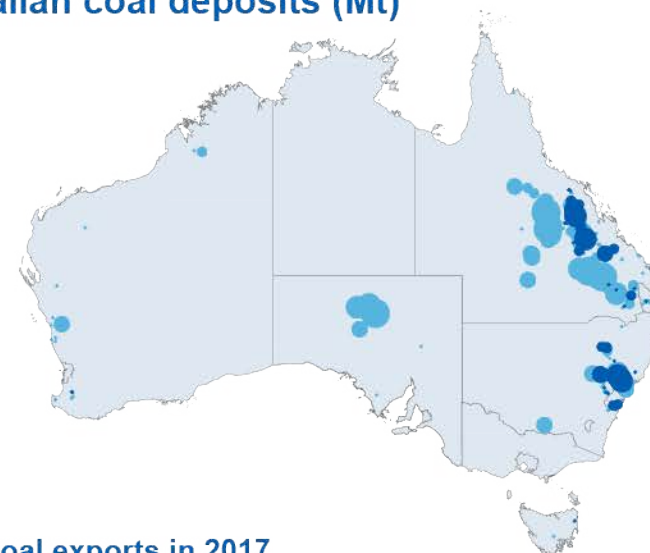


Australia exported **179** million tonnes in 2018, valued at **\$41 billion**



Major Australian coal deposits (Mt)

- <500
- 500-1,000
- 1,001-2,000
- 2,001-4,000
- >4,000
- Deposit
- Operating mine



Australia's metallurgical coal export earnings by destination, 2018



25%
India



22%
China



20%
Japan



10%
South Korea



6%
Taiwan



17%
Rest of the world

Global share of metallurgical coal exports in 2017



54%
Australia



15%
USA



9%
Canada



8%
Mongolia



7%
Russia



7%
Rest of the world

Global share of metallurgical coal imports in 2017



24%
China



16%
India



16%
Japan



15%
EU



12%
South Korea



17%
Rest of the world

5.1 Summary

- The premium Australian hard coking coal (HCC) spot price has been resilient in the first half of 2019, reflecting a tight market. With supply growth expected to outpace demand, the premium HCC spot price is forecast to decline from an average of US\$207 a tonne in 2018 to US\$198 a tonne in 2019, and decline further to US\$160 a tonne in 2021.
- Australia's export volumes are expected to grow from an estimated 180 million tonnes in 2018–19 to 198 million tonnes by 2020–21. This reflects both an expected recovery from supply disruptions and production growth from restarts and new operations in the Bowen Basin.
- Australia's metallurgical coal export earnings are estimated to have reached a new record of \$42 billion in 2018–19. A forecast decline in prices is expected to reduce export earnings to \$36 billion in 2020–21.

5.2 Prices

The seaborne metallurgical coal market has remained relatively tight

The premium Australian hard coking coal (HCC) spot price has remained resilient in recent months, due to tight market conditions. The price traded in a very narrow band of between US\$200 and US\$213 a tonne between April to early June, before dipping below US\$200 (Figure 5.1).

Figure 5.1: Australian premium HCC spot price, daily



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

At an estimated average of US\$205 a tonne in the June quarter, the price was only marginally lower than the March quarter, but 7.2 per cent higher year-on-year. Strong Chinese import demand — with Chinese steel production hitting a record high in April — has offset the impact of subdued imports from other nations. Supply from most exporters, including Australia, has been steady.

The premium HCC spot price is forecast to ease from current levels, but remain well supported over the rest of the year, averaging US\$198 a tonne in 2019. China is responding to slower economic growth and trade tensions with stimulatory measures, including looser monetary policy, tax cuts and new packages of infrastructure investment and construction. This is driving robust growth in steel output, and consequently metallurgical coal imports. A recovery in Indian metallurgical coal imports is also expected to boost demand growth.

The metallurgical coal price is forecast to gradually ease

The premium HCC spot price is forecast to drift lower over the outlook period, to average US\$170 a tonne in 2020 and US\$160 a tonne by 2021, broadly unchanged from the forecast in the March 2019 *Resources and Energy Quarterly*. Supply growth is expected to gradually outpace demand growth, placing downwards pressure on the metallurgical coal price.

Expected fluctuations in Chinese demand are expected to add considerable volatility to the metallurgical coal price over the outlook period. Steel production in China is expected to decline towards the end of the outlook period, leading to a slowdown in growth for metallurgical coal imports. The outlook for Chinese metallurgical coal demand remains subject to considerable uncertainty, with the extent of any further economic slowdown and import policies representing key risks to the metallurgical coal price forecast.

On the supply side, most major exporters, including Australia, Russia, Canada, Mozambique and Mongolia are expected to increase exports. Given Australia's dominance of the seaborne market, weather, infrastructure and other disruptions in Queensland have the potential to drive intermittent price spikes.

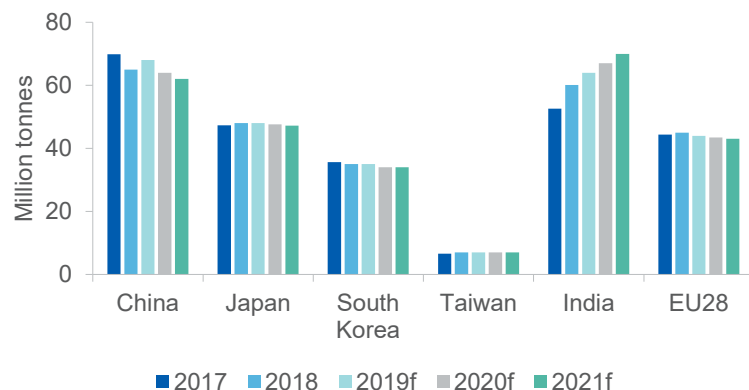
5.3 World trade

World trade in metallurgical coal grew by a robust 12 per cent to 328 million tonnes in 2018. The surge reflected strong global economic conditions and industrial production — which spurred rising steel production — and disrupted supply in 2017 due to Cyclone Debbie. As 2019 progresses, slowing industrial production growth and a deteriorating global economic outlook (see the *macroeconomic outlook* chapter) is expected to weigh on metallurgical coal demand. World metallurgical coal trade is forecast to grow at an average annual rate of 1.2 per cent over the outlook period, to reach 340 million tonnes in 2021.

World imports

Strong Chinese steel production has driven substantial growth in metallurgical coal demand in the first half of 2019. However, softening investment and a stagnant auto market has led to subdued metallurgical coal import demand outside of China. Over the outlook period, India is expected to emerge as the key source of demand growth and overtake China as the world's largest importer, as its domestic steel sector continues to expand. Demand is projected to be subdued or decline marginally among most other major importers, including China, as economic growth slows (Figure 5.2).

Figure 5.2: Metallurgical coal imports



Notes: f Forecast

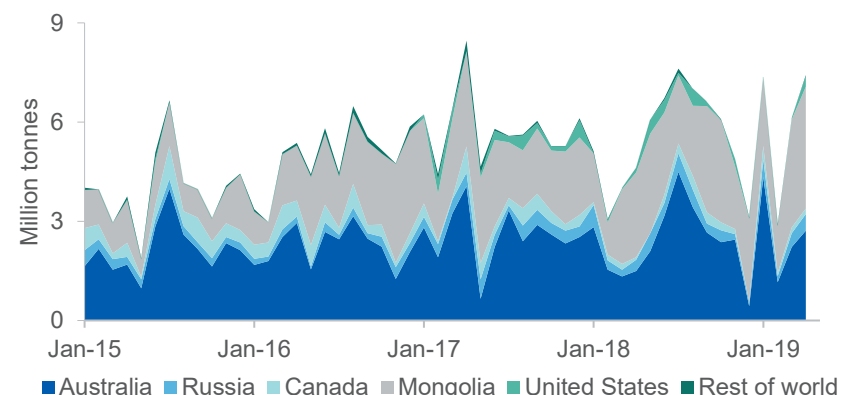
Source: IHS (2019); Department of Industry, Innovation and Science (2019)

China's metallurgical coal imports forecast to ease

Seasonal influences and import policies have led to fluctuations in China's metallurgical coal imports over 2019 (Figure 5.3). Chinese imports fell sharply on a month-to-month basis in February — as they do every year, due to the Lunar New Year celebrations — and by 5.0 per cent year-on-year, as extended customs clearance times held up cargoes at some ports. Imports rebounded in March and April, growing by 57 per cent year-on-year. Part of the surge reflects a bounce back from the impact of import policies, as cargoes that were delayed at ports in February passed through after 40 day delays.

Robust steel production has also boosted import demand for metallurgical coal. China's steel sector has been buoyed by government stimulatory measures, including tax cuts and increased infrastructure investment (see the *steel* chapter).

Figure 5.3: China's metallurgical coal imports



Source: Bloomberg (2019) National Bureau of Statistics of China

While a weakening Chinese Purchasing Managers Index (PMI) and slowing industrial production growth points to the potential for softening steel production, China's imports of metallurgical coal are forecast to be well supported by stimulatory government policies in 2019. The government is expected to prioritise economic stability against a backdrop of growing trade tensions and economic risks.

Metallurgical coal imports are forecast to gradually decline from 68 million tonnes in 2019 to 62 million tonnes in 2021, as the Chinese government eases back on the stimulatory policies, and as steel production moderates in line with economic growth. As always, developments in China represent a major risk to the outlook, with China's fiscal and monetary policy changes potentially driving significant shifts in metallurgical coal imports. While imports are forecast to decline, China is expected to be more reliant on imports for metallurgical coal compared to thermal coal, particularly for higher quality grades as these are more difficult to source domestically.

India's metallurgical coal imports have slowed at the start of 2019

In contrast to the surge in India's imports of metallurgical coal last year, the first four months of 2019 have been sluggish. India's steel production has been largely flat, weighed down by slimmer profit margins and subdued consumption across the country. Infrastructure projects and investment slowed in the lead up to the May general election. Imports of metallurgical coal are expected to recover following the conclusion of the elections, with infrastructure investment and urban development expected to remain a government priority.

India's metallurgical coal imports are projected to grow at an average annual rate of 5.2 per cent over the outlook period, reaching 70 million tonnes by 2021. India has very limited domestic reserves of metallurgical coal, and will need to increase imports to support the rapid growth of its domestic steel sector. Steel production is expected to grow to meet rising domestic consumption. However, the pace at which India's steel sector is able to expand remains uncertain, and presents a risk to the outlook, with the sector facing ongoing financial, regulatory and other challenges.

Japan and South Korea's imports expected to remain subdued

Japan's imports of metallurgical coal fell by 40 per cent year-on-year in the first three months of 2019. Crude steel production fell by 5.8 per cent over the same period, due to production disruptions and slowing residential and Olympics-related construction. Metallurgical coal imports are forecast to decline to 47 million tonnes by 2021, weighed down by subdued economic growth.

South Korea's imports of metallurgical coal declined by 10 per cent year-on-year in the first three months of 2019, despite steel production growing by 1.1 per cent over the same period. Demand for metallurgical coal may have been dampened by high prices. Imports from Australia declined by 30 per cent, while imports from Russia were flat, and imports from Canada increased by 31 per cent, reflecting growing diversification in where South Korea sources metallurgical coal. South Korea's metallurgical coal imports are forecast to decline slightly to 34 million tonnes by 2021.

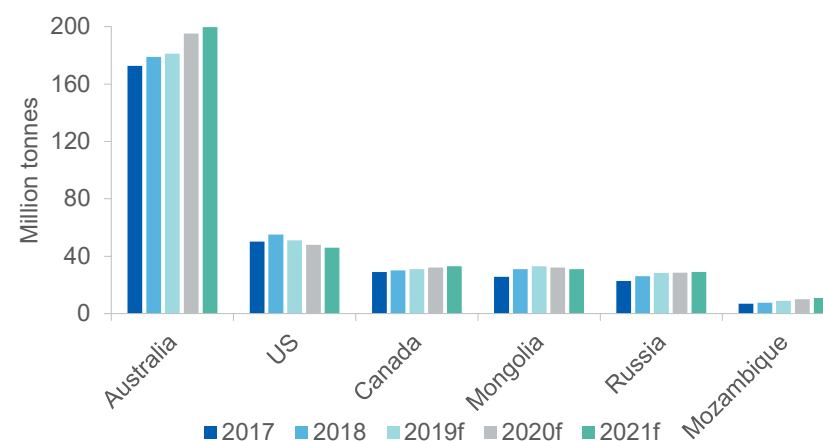
Metallurgical coal imports forecast to rise in emerging economies

Metallurgical coal imports are forecast to grow in South East Asia, although from a low base. Several blast furnace steel plants are expected to come online over the outlook period, notably in Vietnam, supporting import demand for metallurgical coal.

World exports

Persistently strong market conditions in 2017 and 2018 encouraged the restart of idled operations and decisions to proceed with new metallurgical coal mines, supporting supply growth out to 2021 (Figure 5.4).

Figure 5.4: Metallurgical coal exports



Notes: f Forecast

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

Australia is expected to comfortably dominate the seaborne metallurgical coal market, accounting for over half of world exports in 2021. However, Australia's market share is expected to remain lower than the pre-Cyclone Debbie period (the share reached 60 per cent in 2016), with Russia, Canada, Mozambique and Mongolia all increasing their exports and their relative share of the internationally traded metallurgical coal market.

Exports from the United States forecast to ease

After solid growth over the last two years, metallurgical coal exports from the US declined by 11 per cent year-on-year in the first four months of the year. Exports to India declined by 40 per cent over the same period, due to subdued steel production in the lead up to the general election. Indian steel mills turned to US supplies in the second half of 2017, to fill the loss of Australian supply caused by Cyclone Debbie.

Metallurgical coal exports are projected to decrease at an average annual rate of 5.8 per cent to reach 46 million tonnes by 2021. As a marginal supplier of coal to Asia — due to both higher freight and production costs — the US is forecast to reduce its metallurgical coal exports modestly over the outlook period as prices ease and exports from other producing countries increase. Several US mine closures — due to resource depletion — are also expected to weigh on exports over the next few years.

Exports forecast to grow from Russia

Russia's metallurgical coal exports grew by 21 per cent year-on-year in the March quarter of 2019, driven by increased sales to the Asian market. Russia's metallurgical coal exports are forecast to grow at an annual average rate of 3.7 per cent to reach 29 million tonnes by 2021, supported by a weaker Ruble, new additions to mining capacity, and by rail and port expansions. The potential sale and expansion of the Elga mine could further contribute to export growth, but will require substantial capital investment.

New capacity expected to support Canada's export growth

Canada's metallurgical coal exports increased by 4.7 per cent year-on-year in the first four months of the year. Strong market conditions in the

last couple of years have spurred new interest in metallurgical coal projects, supporting supply growth. Metallurgical coal exports are forecast to continue to grow at an average annual rate of 3.2 per cent to reach 33 million tonnes by 2021, driven by restarts and new capacity.

Mozambique's exports to grow, but headwinds remain

After solid growth of around 7.9 per cent or 1 million tonnes in 2018, Mozambique's metallurgical coal exports were disrupted in early 2019 by Cyclone Idai, which closed the Beira port for a month.

Exports are forecast to continue to grow steadily, to reach 11 million tonnes by 2021. The most notable project is Vale's Moatize coal mine, which is expected to be the key source of export growth over the outlook period. Vale's production guidance for the Moatize mine remains at 14 million tonnes in 2019, with a target of reaching 20 million tonnes by 2021. Metallurgical coal is expected to account for over half of those volumes. The outlook for Mozambique's metallurgical coal exports is underpinned by considerable risks, with ongoing uncertainty surrounding a range of logistic, quality and community opposition issues.

Mongolia's metallurgical coal exports to China have rebounded

Mongolia's metallurgical coal exports to China surged by 44 per cent year-on-year in the first four months of 2019. Mongolia — which primarily trucks coal to China at the border — has filled some of the gap left by the reduction in metallurgical coal cargoes going through China's ports in the second month of the year. The rapid growth in Mongolia's exports reflects that Mongolia's coal operations near China's border are relatively flexible, and are able to quickly restart operations and truck coal overland to China.

Mongolia's metallurgical coal exports are forecast to remain subdued over the outlook period. With ongoing transportation bottlenecks, substantial investment in road and rail infrastructure will be required for any sustained growth in export volumes. However, political uncertainty — with recent changes to mining laws — and softening market conditions have slowed plans for expansions and new projects.

5.4 Australia

Australian metallurgical coal export volumes have been slow to pick up

Australia exported 44 million tonnes of metallurgical coal in the March quarter of 2019, an increase of 1.4 per cent year-on-year. Production increases at some operations were offset by scheduled maintenance and longwall moves, and by unfavorable weather-related impacts at other operations. Export earnings totalled \$10 billion over the quarter, an increase of 2.9 per cent year-on-year, supported by higher year-on-year prices.

Metallurgical coal export earnings estimated to have reached a record high

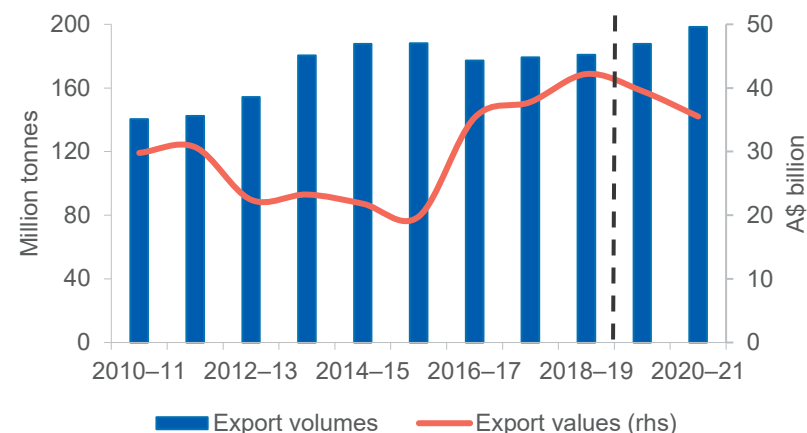
Australia's metallurgical coal export earnings are estimated to have reached a new record high of \$42 billion in 2018–19, up from an existing record of \$38 billion in 2017–18. The strong results were primarily driven by persistently high prices. Export volumes also grew by 0.6 per cent to an estimated 180 million tonnes in 2018–19 (Figure 5.5).

Beyond 2018–19, a forecast moderation of prices is expected to drive a decline in metallurgical coal export earnings, which are forecast to decrease by 6.1 per cent to \$39 billion in 2019–20, and by a further 10 per cent to \$36 billion in 2020–21.

A forecast rise in export volumes is expected to only partially offset the impact of lower prices (Figure 5.6). Export volumes are forecast to grow by 4.1 per cent to 188 million tonnes in 2019–20, and by a further 5.6 per cent to 198 million tonnes in 2020–21.

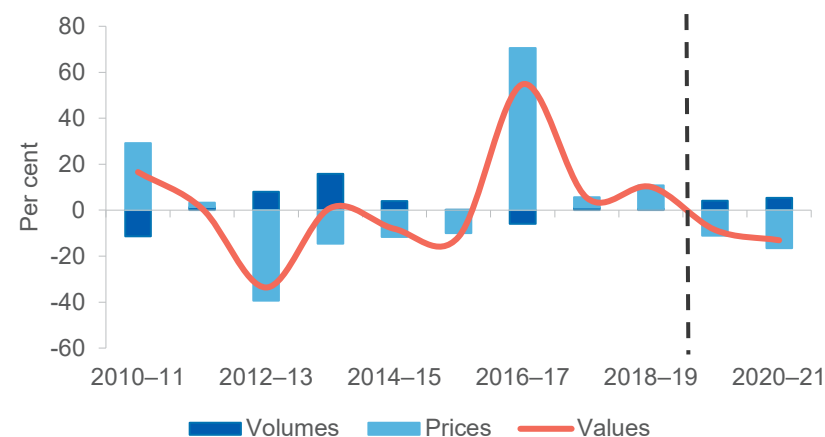
The forecast growth in Australia's metallurgical coal export volumes reflects several factors. A raft of restarts and ramp-ups at key mines, including Cook, Balaraba, Byerwen and Gregory Crinum, are expected to contribute to supply growth (Table 5.1). Supply has also been recovering from disruptions caused by weather, infrastructure, and technical issues. A fire at the North Goonyella mine in late 2018 resulted in a cessation of production. Restart is not expected to continue until at least early 2020.

Figure 5.5: Australia's metallurgical coal exports



Source: ABS (2019) International Trade, Australia 5368.0; Department of Industry, Innovation and Science (2019)

Figure 5.6: Annual growth in Australia's metallurgical coal exports values, and contributions from export volumes and prices



Notes: Price changes are based on export unit values.

Source: ABS (2019) International Trade, Australia 5368.0; Department of Industry, Innovation and Science (2019)

Table 5.1: Metallurgical coal projects in Australia

Project	Company	Development type	Coal type	Capacity (mtpa)	Start date
Byerwen	Qcoal	Greenfield	HCC	10	2017
Cook	Bounty Mining	Restart	HCC	2	2018
Baralaba North	Baralaba Coal Company	Restart	PCI	2-3	2018
Isaac Plains East	Stanmore Coal	Restart	SSC, thermal coal	2	2019
Gregory Crinum	Sojitz	Restart	HCC	6	2020 (est.)
Ironbark No. 1	Fitzroy Resources	Greenfield	HCC, thermal coal	3	2020 (est.)
Olive Downs South	Pembroke Resources	Greenfield	HCC, SSC, PCI	4 (first stage)	2020 (est.)

Notes: **HCC** Hard Coking Coal; **SSC** Semi-soft coking coal; **PCI** Pulverised coal injection; **est.** Estimated start date; Capacity refers to estimated nameplate capacity in million tonnes per annum of saleable production.

Source: Company reports and announcements, IHS Markit (2019); AME Group (2019)

Revisions to the outlook

The forecasts for Australia's metallurgical coal export earnings have been revised up by almost \$500 million in 2019–20 compared to the March 2019 *Resources and Energy Quarterly*. This reflects a revision to the exchange rate, and an upward revision to the 2019 premium HCC spot price forecast, which has been more resilient than originally anticipated. Forecast export earnings in 2020–21 are broadly unchanged compared to the March 2019 *Resources and Energy Quarterly*.

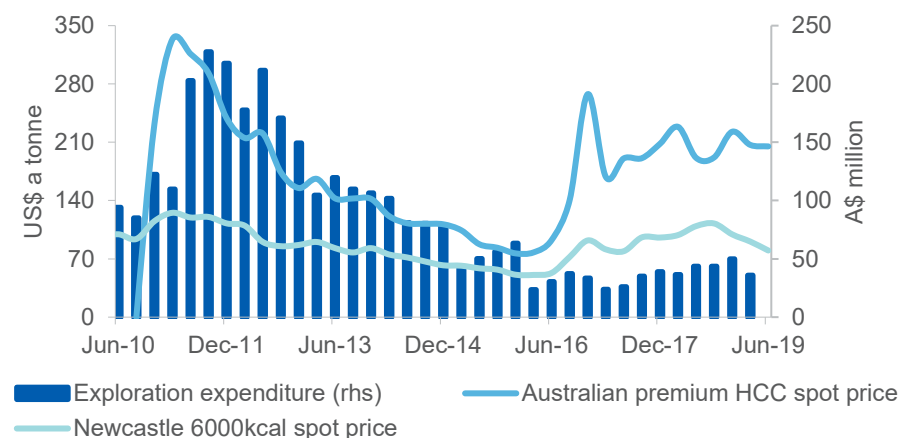
Coal exploration expenditure rebounds

Australia's coal exploration expenditure (including both metallurgical and thermal coal) totaled \$36 billion in the March quarter of 2019, a decrease of 28 per cent from the previous quarter and 1.1 per cent year-on-year (Figure 5.7). Coal exploration activity is generally seasonally weaker in the March quarter due to disruptive weather in Queensland.

Australian coal exploration expenditure remains substantially lower than its peak in 2011. Despite an improvement in market conditions since 2015–16, there are growing challenges for coal projects in Australia and around the world, particularly for thermal coal.

There is a growing reluctance to commit to new greenfield projects, and an expanding list of lenders announcing they will no longer finance thermal coal projects, pension and equity funds divesting from coal, growing community opposition, and challenging regulatory conditions all impacting on investment decisions.

Figure 5.7: Australian coal exploration expenditure and prices



Source: ABS (2019) Mineral and Petroleum Exploration, cat. no. 8412.0; IHS Markit (2019), Platts (2019)

Table 5.2: World trade in metallurgical coal

	Unit	2018	2019 ^f	2020 ^f	2021 ^f	Annual percentage change		
						2019 ^f	2020 ^f	2021 ^f
World trade	Mt	328	334	338	340	1.7	1.2	0.6
Metallurgical coal imports								
China	Mt	65	68	64	62	4.6	-5.9	-3.1
India	Mt	60	64	67	70	6.5	4.7	4.5
Japan	Mt	48	48	48	47	0.0	-0.8	-0.8
European Union 28	Mt	45	44	44	43	-2.2	-1.1	-1.1
South Korea	Mt	35	35	34	34	0.0	-2.9	0.0
Metallurgical coal exports								
Australia	Mt	179	181	195	200	1.3	7.7	2.3
United States	Mt	55	51	48	46	-7.3	-5.9	-4.2
Canada	Mt	30	31	32	33	3.3	3.2	3.1
Russia	Mt	26	28	29	29	9.1	0.5	1.8
Mongolia	Mt	31	33	32	31	6.5	-3.0	-3.1
Mozambique	Mt	8	9	10	11	20.0	11.1	10.0

Notes: ^f Forecast

Source: IEA (2018) Coal Information 2018, accessed through the IEA 20/20 Professional Browser; IEA (2018) Coal Market Report 2018; IHS (2019); Department of Industry, Innovation and Science (2019)

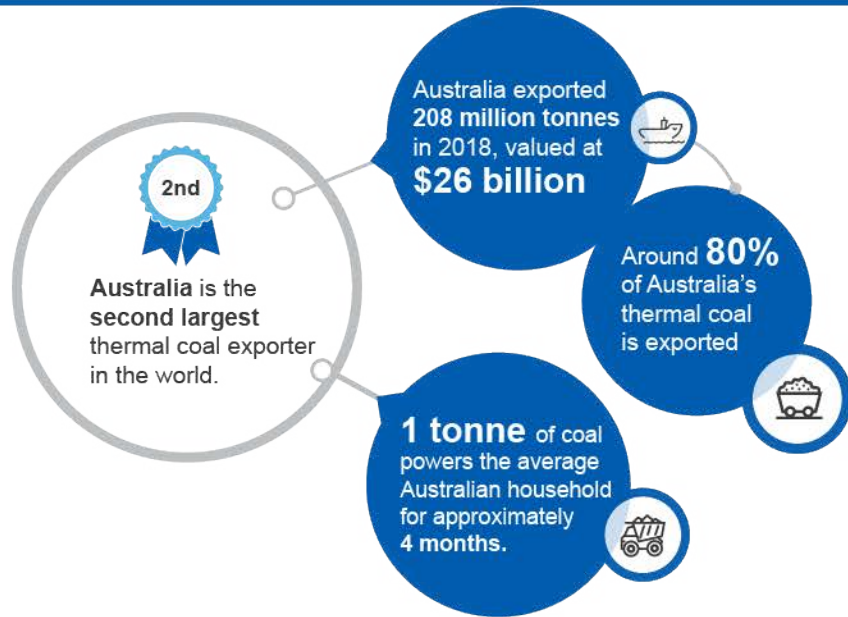
Table 5.3: Metallurgical coal outlook

						Annual percentage change		
World	Unit	2018	2019 ^f	2020 ^f	2021 ^f	2019 ^f	2020 ^f	2021 ^f
Contract prices ^e								
– nominal	US\$/t	208	201	171	160	-3.0	-14.9	-6.3
– real ^d	US\$/t	212	201	167	153	-5.1	-16.8	-8.3
Spot prices ^g								
– nominal	US\$/t	207	198	170	160	-4.5	-14.3	-5.6
– real ^d	US\$/t	212	198	166	153	-6.6	-16.2	-7.6
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2019–20 ^f	2019–20 ^f	2020–21 ^f
Production	Mt	183	181	190	200	-1.5	5.1	5.6
Export volume	Mt	179	180	188	198	0.6	4.1	5.6
– nominal value	A\$m	37,793	42,045	39,498	35,506	11.3	-6.1	-10.1
– real value ⁱ	A\$m	38,546	42,045	38,572	33,840	9.1	-8.3	-12.3

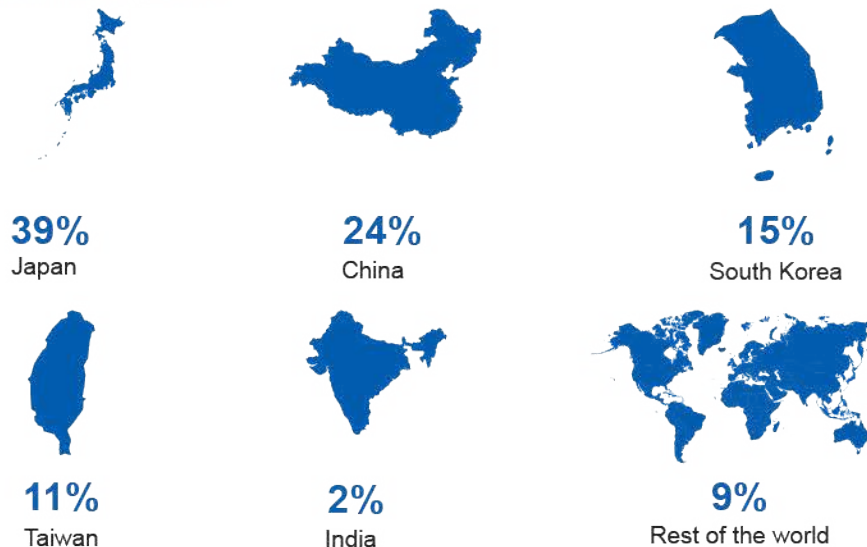
Notes: ^d In 2019 US dollars. ^e Contract price assessment for high-quality hard coking coal. ⁱ In 2018–19 Australian dollars. ^f Forecast. ^g Hard coking coal fob Australia east coast ports. ^s Estimate.
Source: ABS (2019) International Trade in Goods and Services, Australia, 5368.0; Department of Industry, Innovation and Science (2019); Platts (2019)

Thermal Coal

Resources and Energy Quarterly June 2019

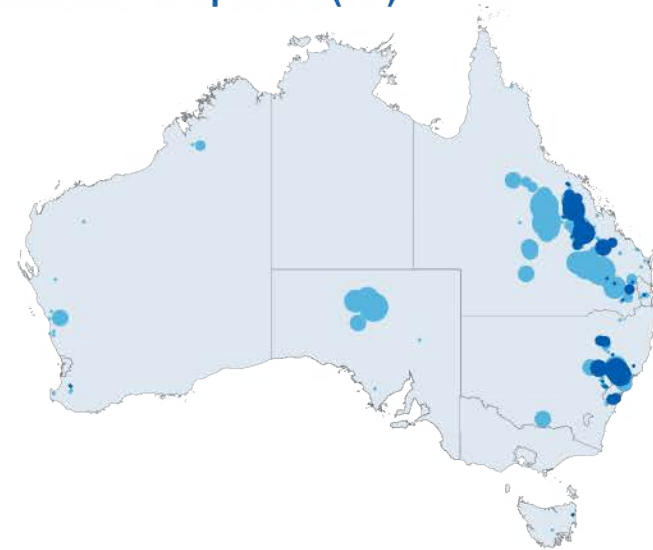


Australia's thermal coal export earnings by destination, 2018

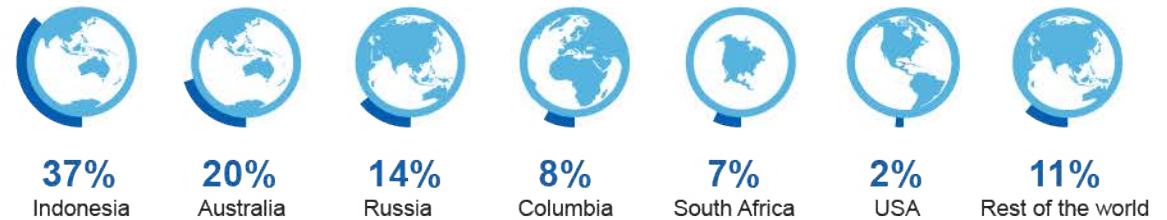


Major Australian coal deposits (Mt)

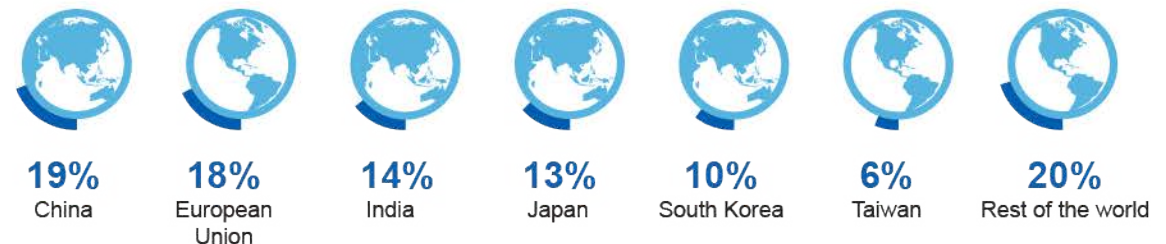
- <500
- 500-1,000
- 1,001-2,000
- 2,001-4,000
- >4,000
- Deposit
- Operating mine



Global share of thermal coal exports in 2017



Global share of thermal coal imports in 2017



6.1 Summary

- The Newcastle benchmark spot price is forecast to decline from an average of US\$105 a tonne in 2018 to US\$83 a tonne in 2019, and to US\$70 a tonne in 2021, as supply growth outpaces demand.
- Australia's export volumes are forecast to grow from an estimated 209 million tonnes in 2018–19 to 216 million tonnes in 2020–21, reflecting modest production growth from new capacity and expansions, a recovery from recent disruptions, and productivity improvements.
- Australia's thermal coal export earnings reached an estimated \$26 billion in 2018–19, a record high. Strong growth in export earnings has primarily been driven by high prices in 2018. Export earnings are forecast to decline to \$19 billion by 2020–21, as the impact of lower prices offsets higher export volumes.

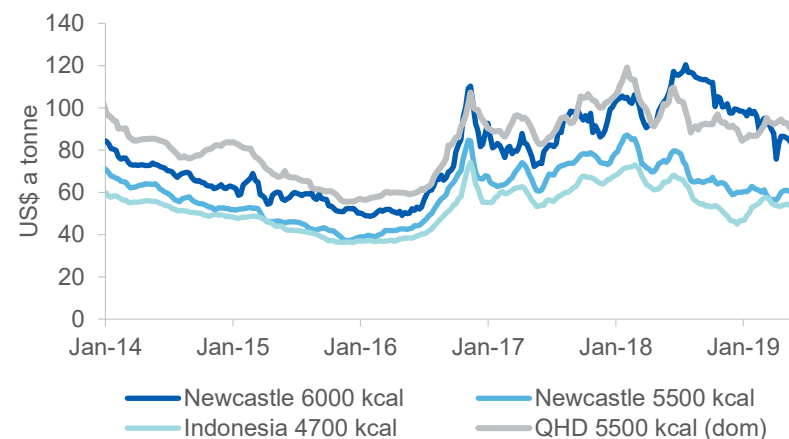
6.2 Prices

Thermal coal prices have declined on weaker fundamentals

The thermal coal benchmark spot price (Newcastle 6,000 kcal/kg NAR) declined sharply in early April, reaching a 22-month low of US\$76 a tonne (Figure 6.1). The price subsequently rebounded before resuming a slide down, placing the overall June quarter average at an estimated US\$80 a tonne — 12 per cent lower than the previous quarter and 27 per cent lower year-on-year.

A range of seasonal influences and other drivers have placed downward pressure on the thermal coal price. Northern hemisphere demand has been seasonally weak in the post-winter heating season. Both hydro and nuclear power generation have picked up in China, displacing coal-fired power generation. A range of import measures and policies at China's ports have added uncertainty into the market, although imports rebounded in April. A fall in LNG spot prices has also encouraged some coal-to-gas switching in Asia and Europe, further dampening demand. These trends have occurred against a backdrop of large volumes of thermal coal entering the seaborne market over the last two years, resulting in an oversupplied market.

Figure 6.1: Thermal coal prices



Source: IHS (2019)

Thermal coal price forecast to remain subdued over the outlook period

The benchmark thermal coal price is forecast to decline from an average of US\$83 a tonne in 2019 to US\$70 a tonne in 2021. The Asian thermal coal market is expected to remain well supplied over the next two and a half years, from Australia, Russia, and Indonesia. Demand from the traditional Asian buyers is expected to remain subdued, offsetting gains from emerging Asia.

The Japanese contract price — which serves as a reference price for the Asian market — is also forecast to decline in tandem with the spot price. The 2019–20 (April 2019 to March 2020) contract price was settled at US\$95 a tonne, and is forecast to settle at US\$78 a tonne in 2020–21.

There are several risks to the price outlook for thermal coal. Developments in China's domestic coal market and import policies remain the key risk to the outlook, and could drive ongoing volatility in thermal coal demand. Supply from marginal producers in Indonesia and the United States could take longer than expected to contract, requiring lower prices to bring the market back to balance. Countering these headwinds are the possibility of stronger-than-expected imports from emerging Asia, and from Japan, where nuclear reactors may shut if key regulatory deadlines are missed.

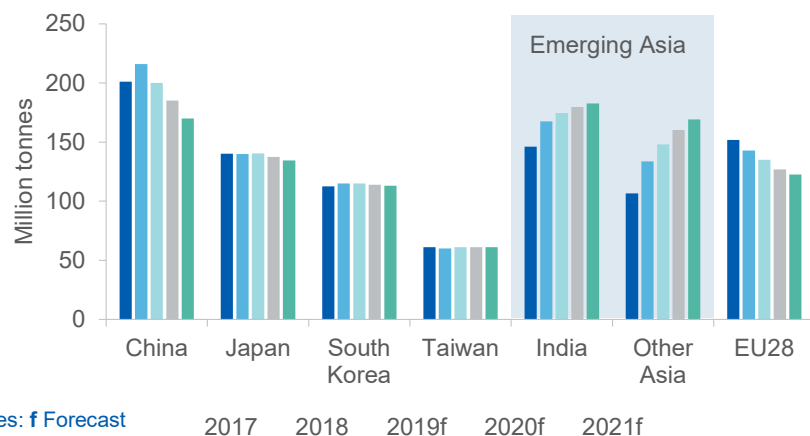
6.3 World trade

The last two years saw strong demand and high prices that attracted more supply to the seaborne market. The start of 2019 saw these trends begin to reverse. Over the outlook period, the seaborne market is expected to gradually contract at an average annual rate of 0.5 per cent between 2018 and 2021, and remain at around 1.1 billion tonnes.

World imports

Thermal coal import demand experienced a slow start to 2019. While demand is expected to pick up after the June quarter seasonal lull, the trend for world imports over the outlook period is likely to be slightly downwards. Imports from most developed countries are forecast to decline, as governments phase out coal-fired power generation. China's thermal coal imports are forecast to moderate, as domestic production continues to grow, and as the impacts of various government policy changes take effect. Countering these trends, countries in emerging Asia are expanding their coal-fired power generation and have seen stronger-than-expected import growth (Figure 6.2). The overall net result of these divergent trends is a marginal decline in imports out to 2021.

Figure 6.2: Thermal coal imports



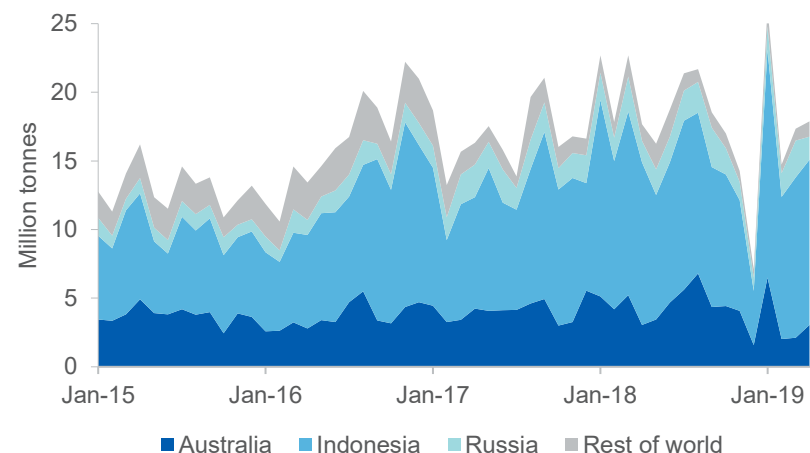
Notes: f Forecast

Source: IHS (2019); IEA (2018) Coal Market Report; Department of Industry, Innovation and Science (2019)

China's thermal coal imports forecast to moderate

China's thermal coal imports in 2019 to date have been affected by a range of seasonal and policy drivers. Imports reached a near-record high in January, as buyers restocked after an annual import quota was enforced towards the end of 2018. Imports then fell sharply in the subsequent two months, dropping by 21 per cent year-on-year, amid lunar new year celebrations in early February. Imports also decreased as a result of import policies, such as enhanced quality testing, which led to delays at several ports (Figure 6.3). Imports rebounded in March and April, but were still lower on a year-on-year basis by 13 per cent.

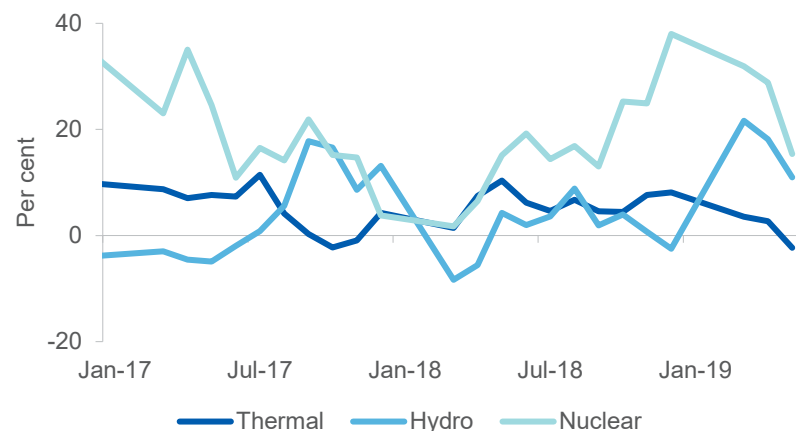
Figure 6.3: China's monthly thermal coal imports



Source: Derived from data obtained from Bloomberg (2019) National Bureau of Statistics of China

Demand has been dampened by a pick-up in hydro and nuclear power generation — which increased by 16 and 25 per cent year-on-year, respectively, in the year to May — which has displaced coal-fired power generation (Figure 6.4). China's thermal coal imports are forecast to decline over the next two and a half years, reaching 170 million tonnes in 2021. A softening Purchasing Managers Index (PMI) and a shrinking share of coal in power generation points to softening demand.

Figure 6.4: China's electricity generation, year-on-year change



Notes: Thermal includes coal and gas-fired power generation

Source: Bloomberg (2019) National Bureau of Statistics of China

Further reducing the need for imports, Chinese coal production is expected to grow over the outlook period — after three years of industry reforms, the bulk of capacity closures are largely concluded and new additions to capacity are on their way. China's railway logistics have also been enhanced since 2018, improving the connections between the nation's coal producing regions and main demand centres.

However, the possibility of weaker-than-expected domestic production in China provides a potential tailwind for imports. A spate of accidents in recent months has resulted in a new wave of safety checks and production halts at domestic operations, which has placed upwards pressure on domestic thermal coal prices (see Figure 6.1).

Policy uncertainty has been — and is expected to continue to be — a key risk to the outlook (see Box 6.1 in the March 2019 *Resources and Energy Quarterly*). The government is expected to continue to manage overall import levels to achieve various goals, including balancing domestic consumption and production, stabilising domestic coal prices, and supporting the domestic industry to counter the effects of trade tensions with the US.

Japanese thermal coal imports to gradually decline

Japan's imports of thermal coal totalled 36 million tonnes in the March quarter of 2019, a decrease of 1.6 per cent year-on-year. Over the same period, imports of thermal coal from Australia decreased by 2.0 per cent, while imports from the US and Russia both increased by around 19 per cent. Japanese power utilities have continued to change their purchasing patterns, driven by power sector reforms aimed at boosting competition and energy security. As a result, utilities have been diversifying their sources of supply and purchasing more coal on short term contracts and at spot to minimise costs. Japan's imports of thermal coal are forecast to contract at an annual average rate of 1.3 per cent, reaching 134 million tonnes in 2021. A gradual decline in coal-fired power generation is expected to be driven by ongoing nuclear restarts and low LNG spot prices — encouraging coal-to-gas switching.

At the time of writing, nine of Japan's fleet of 42 nuclear reactors are in operation, and at least another three reactors are likely to restart by 2021. However, the outcomes of safety reviews and ongoing community opposition to some of these could lead to delays. In particular, Japan's nuclear regulation authority has stated that it would order shutdowns on any reactors that missed deadlines to install counterterrorism measures. Up to nine reactors, including five that are operational, are at risk of missing these deadlines over the outlook period to 2021. While LNG is expected to be the main beneficiary of any shutdowns, there is also the potential for stronger-than-expected thermal coal demand.

There have been growing signs that Japan will pivot away from thermal coal at a faster pace than initially expected. Two coal-fired power projects have been cancelled in the last six months, with a third also likely to be shelved soon, the Japanese Environment Minister announced opposition to any new plans to build or expand coal-fired power stations (although approval for new plants comes from the Minister of Economic, Trade and Industry), and there has been a growing number of financial and corporate institutions divesting from coal-fired power generation and thermal coal mines.

South Korea's coal imports to decline as energy transition accelerates

South Korea imported 27 million tonnes of thermal coal in the March quarter of 2019, a decrease of 5.2 per cent year-on-year. South Korea's thermal coal imports are forecast to marginally decline at an annual average rate of 0.6 per cent, to reach 113 million tonnes in 2021.

Since the change in government in 2017, South Korea has implemented a range of measures to reduce the country's reliance on coal-fired power generation. These include the cancellation of new coal-fired power plant capacity, the shutdown of older plants when the air quality is poor, and a shift in taxes to encourage a move away from coal and towards gas. From 1 April this year, the import tax on LNG was further lowered by 75 per cent, while the tax on coal was raised by 28 per cent. The South Korean government's third Basic Energy Plan was finalised in June 2019, and points to a shrinking role for coal-fired power in the country's energy system over the next three decades.

Taiwan's coal imports are forecast to remain steady

Taiwan's thermal coal imports have remained broadly steady in the year to date, with this trend forecast to continue. Imports are expected to remain at around 61 million tonnes a year over the outlook period.

India's thermal coal consumption is set to outpace production

India's thermal coal imports grew by 18 per cent year-on-year in the March quarter of 2019. Domestic production of thermal coal — while growing by an estimated 5.3 per cent over the same period and reaching record levels — failed to keep pace with the rapid growth in thermal coal consumption. Thermal coal consumption has been supported by high energy demand, due to strong economic growth. The government also sought to maintain the reliability of electricity in the lead up to the May general election, further increasing demand for coal-fired power generation.

While the government has a long-term goal to reduce thermal coal imports to zero, India's thermal coal imports are forecast to remain at high levels in the short-term, reaching 183 million tonnes in 2021. Demand growth is expected to continue outpacing domestic supply growth, which is likely to

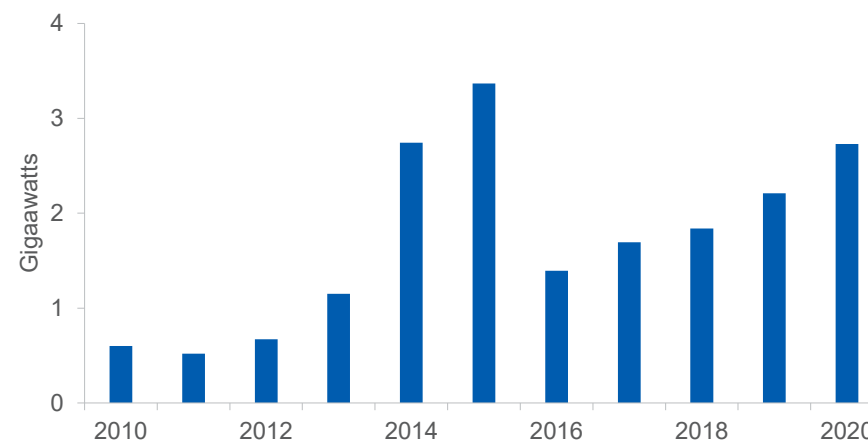
be constrained by regulatory and infrastructure challenges. Further supporting imports, the Central Electricity Regulatory Authority (CERC) has amended rules which will now allow domestic thermal power companies to be compensated for the additional costs incurred in plants that use imported coal.

Vietnam continues to be a key source of thermal coal import growth

Strong economic growth in Vietnam has continued to drive growing coal-fired power generation. Vietnam's coal imports have surged, primarily benefiting Indonesia and Australia. While Vietnam has large reserves of coal, predominantly in the north, most of the new coal-fired power plants are fueled by imported coal, due to their southern location and quality requirements.

Vietnam's thermal coal imports are forecast to grow at an average annual rate of 16 per cent, reaching 30 million tonnes in 2021, driven by growing power demand and coal-fired power capacity. An estimated 5 gigawatts of coal-fired power capacity is expected to come online in 2019 and 2020 (Figure 6.5). However, there will be some challenges to resolve, as Vietnam's coal import needs come up against port and rail capacity constraints.

Figure 6.5: Coal-fired power generation capacity additions in Vietnam

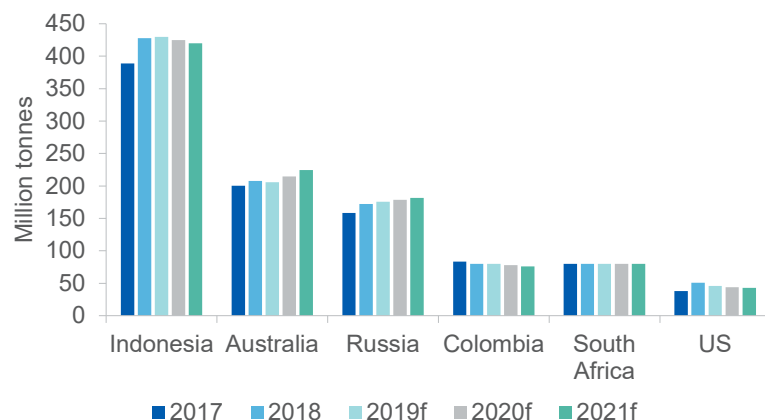


Source: IHS Markit (2019)

World exports

While supply declined from the US, South Africa and Colombia in the first few months of 2019, this was more than offset by export growth elsewhere. These trends are expected to continue, with Australia and Russia likely to be the key sources of export growth over the outlook period (Figure 6.6).

Figure 6.6: Thermal coal exports



Notes: f Forecast

Source: IHS (2019); ABS (2019) International Trade, Australia 5454.0; Department of Industry, Innovation and Science (2019)

Indonesia's thermal coal exports to soften, but remain at high levels

Indonesia's thermal coal exports grew by 11 per cent year-on-year in the March quarter of 2019, reaching a record monthly high of 42 million tonnes in March. Thermal coal exports are forecast to remain relatively high, at over 400 million tonnes each year, albeit with some softening from current record levels. Weaker Asian demand, growing domestic consumption and more restrictive government policies are all expected to weigh on exports.

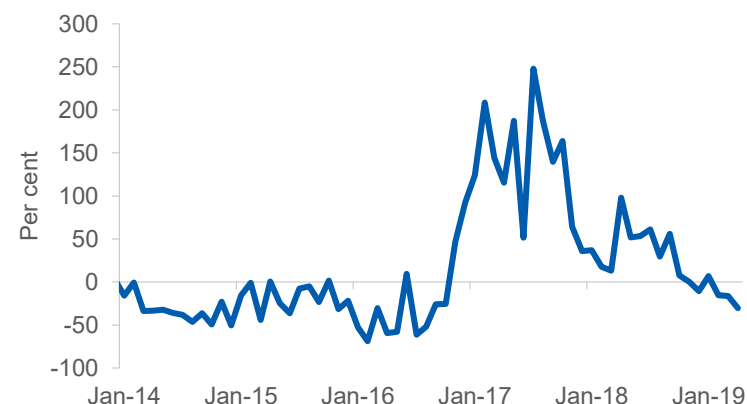
The Indonesian government has targeted national coal production at 480 million tonnes in 2019 — substantially lower than actual output in 2018 of 528 million tonnes — in a bid to stabilise seaborne prices for Indonesian coal. The domestic market obligation (DMO), under which Indonesian producers are obliged to sell a share of production into the domestic

market at capped prices, has been set at 128 million tonnes in 2019. The actual DMO level reached was 115 million tonnes in 2018, coming in under the 121 million tonne target. With the current annualised rate of exports already exceeding the implied targets, there is a possibility that the government could impose lower production quotas on producers that don't meet their targets this year, which could further drag on exports.

Low prices to drive down exports from the United States

After a strong growth cycle, US thermal coal exports have fallen back (Figure 6.7). US thermal coal exports are expected to remain at relatively high levels in 2019, with large volumes of coal exports already booked for the year. However, exports are forecast to decline further in 2020 and 2021, as prices weaken, to reach 43 million tonnes by 2021.

Figure 6.7: US monthly thermal coal exports, year-on-year growth



Source: IHS Markit (2019)

South Africa's coal exports expected to remain steady

South Africa's thermal coal exports declined by 3.6 per cent year-on-year in the first four months of 2019. South Africa's coal exporters have directed supplies towards the domestic market, amid weaker demand from India, softer export prices, and higher domestic prices. Thermal coal exports from South Africa are forecast to remain broadly steady at 80 million tonnes over the outlook period.

Russia's thermal coal exports forecast to grow

Russia's thermal coal exports grew by an estimated 14 per cent year-on-year in the March quarter of 2019, driven by port and rail developments in the east, and a surge in demand from China and South Korea. Russia's thermal coal exports are forecast to continue to grow steadily over the outlook period to reach 182 million tonnes by 2021, supported by strong Asian demand for low sulphur coal, and a weak Ruble.

Colombia's thermal coal exports to remain subdued

Colombia's thermal coal exports declined by 16 per cent year-on-year to 23 million tonnes in the first four months of 2019, primarily due to weaker market conditions. Exports are forecast to decline at an average annual rate of 1.8 per cent to reach 76 million tonnes in 2021.

6.4 Australia

Australia's coal exports volumes resilient

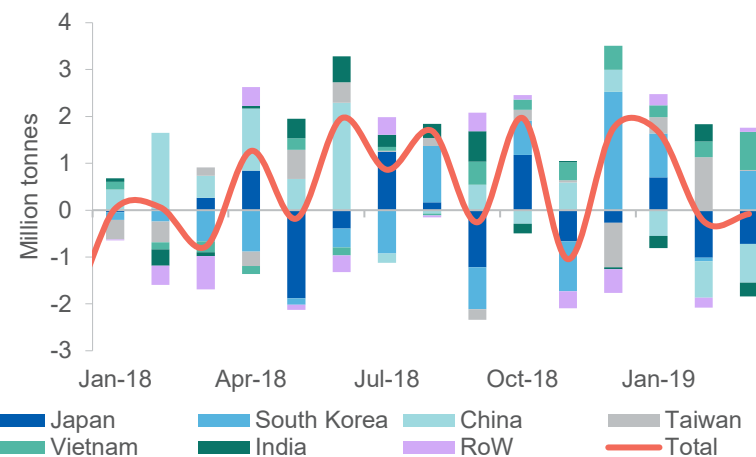
Australia exported 49 million tonnes of thermal coal in the March quarter of 2019, 2.9 per cent higher year-on-year. Export earnings increased by 11 per cent year-on-year over the same period, supported by the high contract price that was settled for the Japanese Financial Year (April 2018 to March 2019). Despite a sharp reduction in exports to China, Australia's thermal coal exports have remained resilient, reflecting a redirection of trade flows (Figure 6.8). While Australia's thermal coal exports to China declined by 19 per cent year-on-year in the March quarter (in volume terms), exports to South Korea increased by 26 per cent and Taiwan by 31 per cent. Exports to Vietnam grew by more than five-fold, although from a low base, driven by the rapid expansion of that country's coal-fired power generation capacity.

Semi-soft and thermal coal price spread could reduce thermal exports

In April, exports of semi-soft coking coal increased by 16 per cent year-on-year, as thermal coal prices fell. If the Newcastle benchmark thermal coal spot price weakens further, relative to the semi-soft coking coal price (Figure 6.9), it could become increasingly more profitable for Australian thermal coal producers with coal-washing facilities to switch to producing

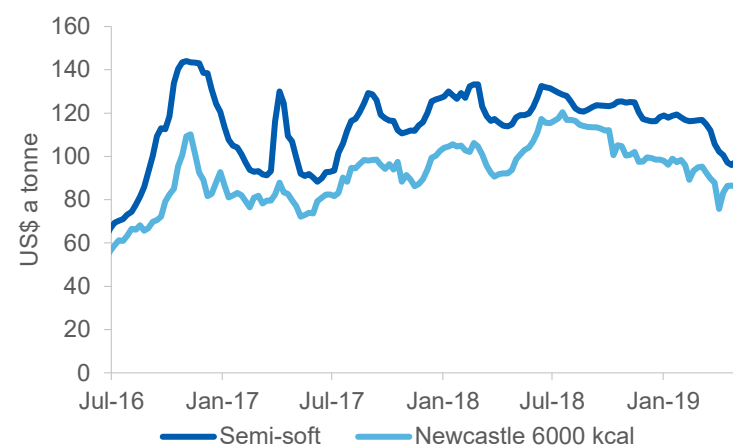
semi-soft coking coal. Thermal coal with suitable properties (such as low phosphorus content) can be converted to semi-soft coking coal for use in steel production through passing the coal through coal wash plants.

Figure 6.8: Australia's thermal coal exports, year-on-year change



Source: ABS (2019) International Trade, Australia 5368.0

Figure 6.9: Thermal coal and semi-soft coking coal prices



Source: IHS (2019); Platts (2019)

Thermal coal export earnings estimated to reach a record high

Australia's thermal coal export earnings are estimated to have grown by 14 per cent to reach a record \$26 billion in 2018–19, up from the previous record of \$23 billion in 2017–18. The strong growth in export earnings is a result of high prices, particularly in the second half of 2018, and solid growth in export volumes.

Export earnings are projected to decline over the outlook period — in line with weaker prices — finishing at \$19 billion in 2020–21. The impact of lower prices is expected to be partially offset by growth in export volumes (Figures 6.10 and 6.11).

Australia's thermal coal export volumes forecast to grow

Australia's thermal coal export volumes are estimated to have reached a record 209 million tonnes in 2018–19, up by 3.2 per cent from 2017–18.

The strong growth in export volumes reflects a recovery from various weather, industrial, technical and infrastructure-related disruptions that weighed on output in previous years, in addition to ongoing productivity improvements and the ramp up of the new Mount Pleasant mine in New South Wales.

Export volumes are forecast to grow by a further 7 million tonnes over the next two years, reaching 216 million tonnes in 2020–21, supported by productivity improvements, expansions, and the ongoing ramp up of the Mount Pleasant mine and other operations. Although there is a large pipeline of potential projects in Australia, there is a growing reluctance to commit to new greenfield projects, which could weigh on export growth beyond the outlook period.

Revisions to the outlook

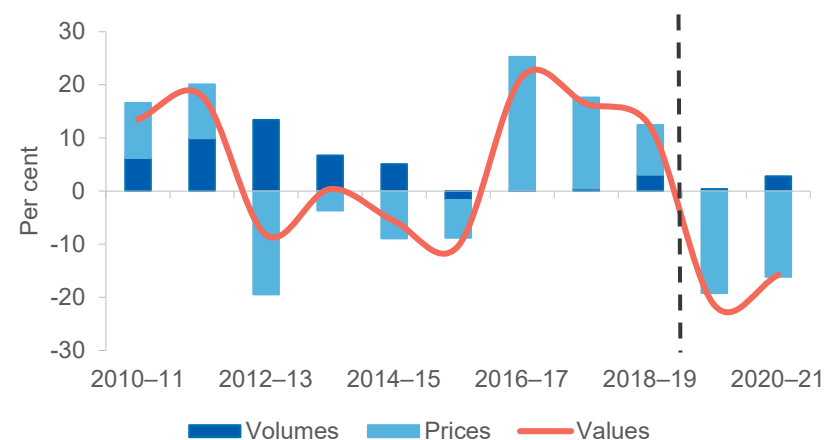
Compared to the forecast in the March 2019 *Resources and Energy Quarterly*, Australia's forecast thermal coal export earnings have been revised down by \$2.9 billion in 2019–20 and by \$3.1 billion in 2020–21. The revision reflects a lower forecast benchmark thermal coal price, which declined at a faster-than-expected pace in the June quarter of 2019, due to weak Asian demand amid a well-supplied market.

Figure 6.10: Australia's thermal coal exports



Source: ABS (2019) International Trade, Australia 5368.0; Department of Industry, Innovation and Science (2019)

Figure 6.11: Annual growth in Australia's thermal coal exports values, and contributions from export volumes and prices



Notes: Price changes are based on export unit values.
Source: ABS (2019) International Trade, Australia 5368.0; Department of Industry, Innovation and Science (2019)

Table 6.1: World trade in thermal coal

	Unit	2018	2019 ^f	2020 ^f	2021 ^f	Annual percentage change		
						2019 ^f	2020 ^f	2021 ^f
World trade	Mt	1,140	1,138	1,132	1,121	-0.1	-0.6	-0.9
Thermal coal imports								
Asia	Mt	832	839	837	830	0.9	-0.2	-0.8
China	Mt	216	200	185	170	-7.3	-7.5	-8.1
India	Mt	168	175	180	183	4.2	2.9	1.7
Japan	Mt	140	140	137	134	0.4	-2.1	-2.2
South Korea	Mt	115	115	114	113	0.0	-0.9	-0.9
Taiwan	Mt	60	61	61	61	1.9	0.0	0.0
Thermal coal exports								
Indonesia	Mt	428	430	425	420	0.5	-1.2	-1.2
Australia	Mt	208	204	214	225	-1.0	4.3	4.7
Russia	Mt	172	176	179	182	2.2	1.7	1.7
Colombia	Mt	80	80	78	76	0.0	-2.6	-2.7
South Africa	Mt	80	80	80	80	0.0	0.0	0.0
United States	Mt	51	46	44	43	-9.8	-3.9	-2.3

Notes: ^f forecast.

Source: IEA (2018) Coal Information 2018, accessed through the IEA 20/20 Professional Browser; IEA (2018) Coal Market Report 2018; IHS (2019); Department of Industry, Innovation and Science (2019)

Table 6.2: Thermal coal outlook

						Annual percentage change		
World	Unit	2018	2019 ^f	2020 ^f	2021 ^f	2019 ^f	2020 ^f	2021 ^f
Contract prices ^b								
– nominal	US\$/t	110	95	78	73	-13.9	-18.1	-6.4
– real ^c	US\$/t	113	95	76	69	-15.8	-19.9	-8.4
Spot prices ^d								
– nominal	US\$/t	105	83	75	70	-21.1	-9.9	-6.3
– real ^e	US\$/t	108	83	73	67	-22.8	-11.9	-8.3
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2019–20 ^f	2019–20 ^f	2020–21 ^f
Production	Mt	267	270	274	280	1.1	1.5	2.2
Export volume	Mt	203	209	210	216	3.2	0.4	2.8
– nominal value	A\$m	22,586	25,632	21,193	18,546	13.5	-17.3	-12.5
– real value ^h	A\$m	23,036	25,632	20,696	17,676	11.3	-19.3	-14.6

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 net as received; ^e In 2019 US dollars; ^f Forecast; ^h In 2018–19 Australian dollars; ^s Estimate.

Source: ABS (2019) International Trade in Goods and Services, Australia, Cat. No. 5368.0; IHS (2019); NSW Coal Services (2019); Queensland Department of Natural Resources and Mines (2019); Company Reports; Department of Industry, Innovation and Science (2019)

Gas

Resources and Energy Quarterly June 2019

LNG is natural gas cooled to
-162°C



largest LNG exporter in the world in 2018

Australia exported
70
million tonnes of LNG in 2018



22%
rise from 2017 export volumes

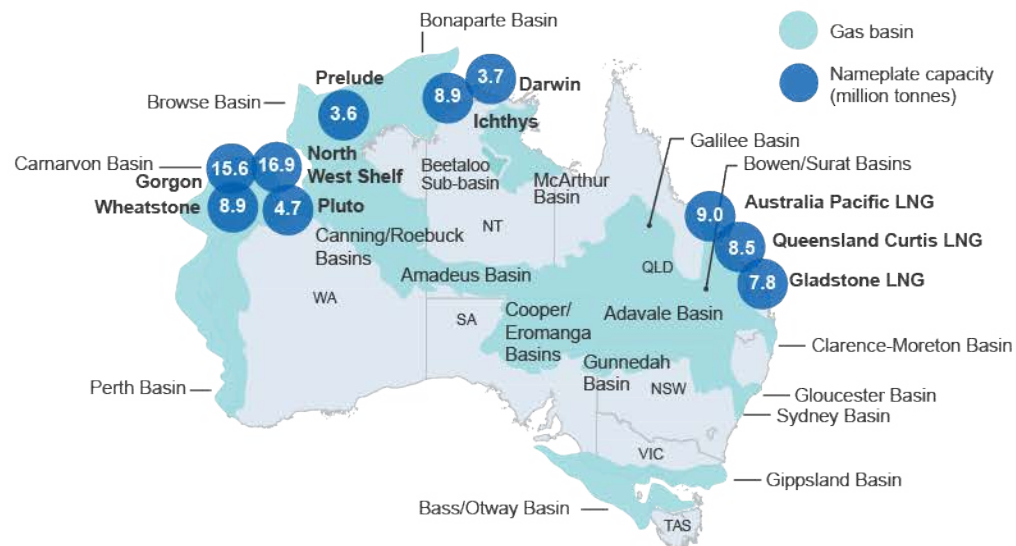


Combined nameplate capacity of Australia's 10 LNG projects is
88 million tonnes per annum

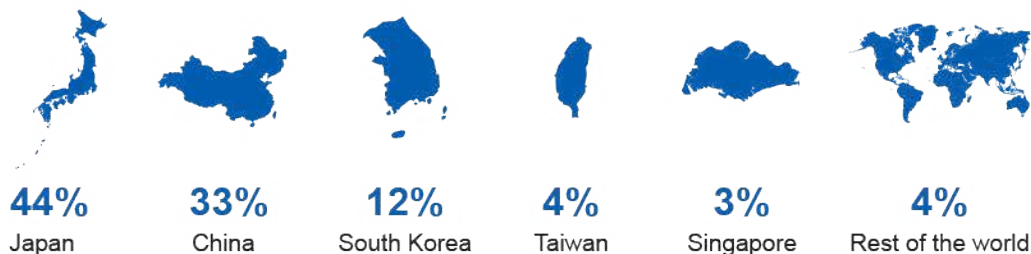


Most Australian LNG is sold at oil-linked contract prices

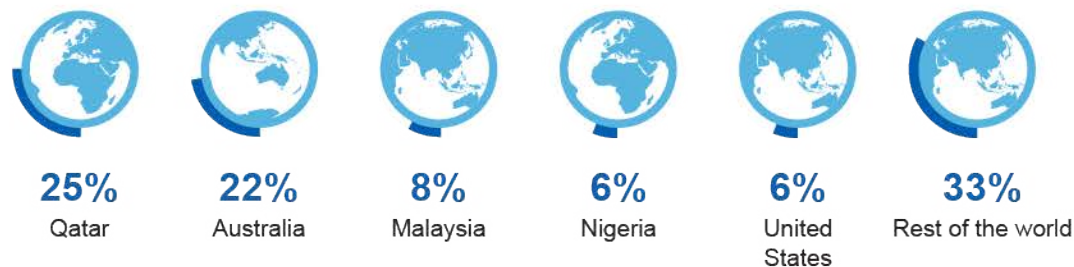
Australia's LNG projects and gas basins



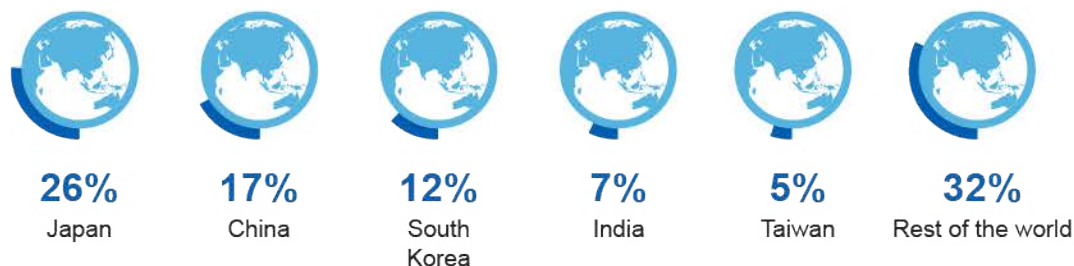
Australia's LNG export earnings by destination, 2018



Share of world LNG exports in 2018



Share of world LNG imports in 2018



7.1 Summary

- Australia exported an estimated \$50 billion of LNG in 2018–19. Export earnings are forecast to lift to \$54 billion in 2019–20, driven by growing export volumes, before falling back to \$50 billion, as prices ease.
- Australia's LNG export volumes are forecast to increase from an estimated 75 million tonnes in 2018–19 to 81 million tonnes in 2020–21, as the last two projects in Australia's recent wave of LNG investment ramp up output.
- Australian LNG export prices are forecast to remain stable in 2019–20 and then decline in 2020–21, due to an appreciating exchange rate and easing LNG contract prices (at which most Australian LNG is sold). LNG spot prices are forecast to remain low, as additions to global capacity outstrip increases in world demand.

7.2 Prices

LNG contract prices in Asia have fallen sharply over the past few months

Gas pricing arrangements vary from region to region. Most LNG in Asia is sold on long-term contracts — sometimes in excess of 20 years — where the price of LNG is linked to the price of oil (by a time lag of several months). Figure 7.1 shows how oil-linked contract prices have fallen sharply over the past few months, due to the lagged effect of the oil price collapse in January and February 2019.

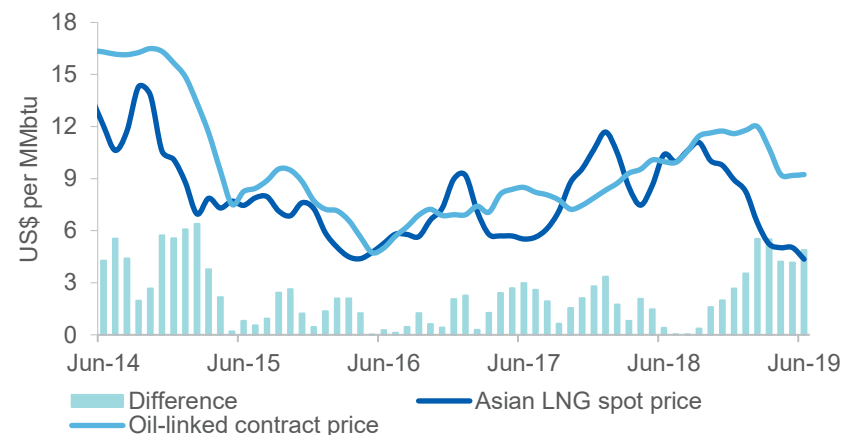
LNG spot prices to remain low

LNG spot prices have declined dramatically since late 2018, even falling through the 2018–19 northern hemisphere winter — a time of the year at which prices would usually spike, due to strong seasonal demand. The price fall has been driven by the ramp up of new capacity in the US, Australia and Russia combined with declining imports in Japan and South Korea — the world's largest and third largest LNG buyers.

The recent fall in LNG spot prices means that they have now diverged substantially from long-term oil-linked contract prices, as shown in Figure 7.1. A key question is what the implications of this decoupling might

be, especially if decoupling endures for a sustained period. Previous periods of low spot prices have encouraged buyers to push for shorter, more flexible contracts and gas-based pricing, and away from traditional oil-linked pricing arrangements.

Figure 7.1: LNG prices, monthly



Notes: The Argus Northeast Asian spot price is shown. LNG prices are DES (Delivered Ex Ship). DES prices include shipping and insurance. The long-term oil-linked contract price is indicative only, and is estimated at 14 per cent of the 3-month lagged Japan Customs-cleared crude oil price plus shipping. The difference between the two LNG prices is in absolute terms.

Source: Argus (2019); Bloomberg (2019)

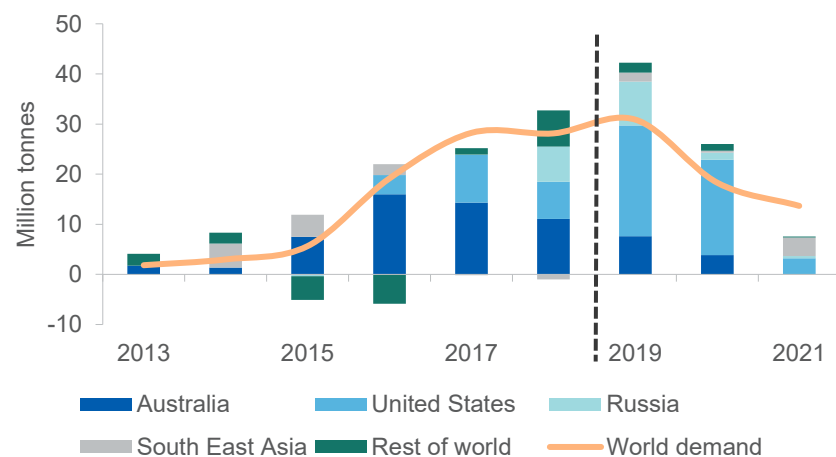
In 2019 and 2020, additions to global supply capacity are expected to outstrip growth in LNG demand. Consequently, Asian LNG spot prices are forecast to remain low, averaging US\$5.70 per million British thermal units (MMBtu) in 2019 (A\$7.60 a gigajoule) and US\$6.80/MMBtu (A\$8.80/GJ) in 2020 — well down on the 2018 average of US\$9.80/MMBtu (A\$12.40/GJ).

In 2021, LNG spot prices are expected to recover to US\$8.40/MMBtu (A\$10.70/GJ). Supply growth looks likely to slow dramatically in the early 2020s, and demand is consequently expected to begin closing the gap on global production capacity. Future movements in Asian spot prices could affect domestic gas prices in Australia's eastern gas market (Box 7.1).

7.3 World trade

LNG trade has grown rapidly over the past few years, driven by surging demand in Asia and the ramp up of new projects commissioned between 2009 and 2015. In 2018, LNG trade totalled an estimated 318 million tonnes, up 10 per cent from 290 million tonnes in 2017. In 2019 and 2020, the continued expansion in global LNG supply capacity is expected to outpace growth in LNG demand, before capacity growth slows dramatically in 2021 (Figure 7.2). From 2021, the LNG market is expected to begin rebalancing, as demand growth absorbs the available capacity.

Figure 7.2: Change in global nameplate capacity and LNG demand



Notes: Nameplate capacity is the maximum annual production capacity of an LNG plant.

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

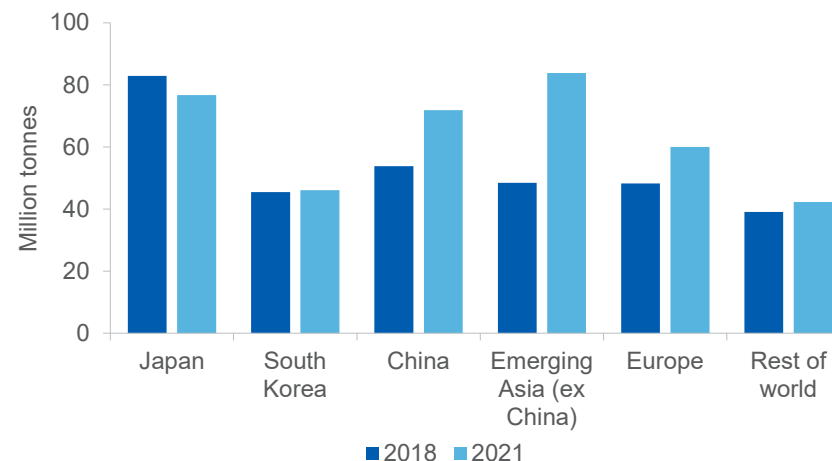
7.4 World imports

Nuclear restarts to reduce Japan's LNG imports

Japan is the world's leading LNG buyer, importing 83 million tonnes of LNG in 2018. However, Japan's LNG imports fell by 10 per cent year-on-year in the first five months of 2019, due to a relatively mild winter and the restart of nuclear power reactors over the past year. Japan's LNG imports are forecast to fall to 77 million tonnes in 2021 (Figure 7.3). Overall energy

demand in Japan is expected to decline slightly. At the same time, LNG is expected to face increasing competition in the electricity generation sector from both nuclear and renewable power generation.

Figure 7.3: LNG import forecasts



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

The restart of several reactors over 2018 is expected to reduce Japan's annual LNG imports from 2019 onwards. At the time of writing, 9 of Japan's 42 nuclear reactors had gained approval to restart and were in operation. Further nuclear restarts appear likely over the next 5 years. Eighteen reactors have applications to restart with the Nuclear Regulation Authority, and at least 3 reactors are likely to restart before end 2021.

However, several eventualities complicate the outlook for nuclear energy in Japan, and could see Japan import more LNG than forecast. In April, Japan's Nuclear Regulation Authority stated that it would order the shutdown of any nuclear reactors that have not met deadlines to implement counterterrorism measures. Up to nine reactors, including five that are operational, are at risk of missing these deadlines over the outlook period (to 2021). In addition, ongoing public opposition to nuclear energy in Japan could delay the restart of more nuclear power reactors.

China to shape future developments in global LNG markets

China was the second largest LNG buyer in the world in 2018, importing 54 million tonnes of LNG (73 billion cubic metres). China's LNG imports continued to increase rapidly in the first five months of 2019, up 19 per cent on the same period a year earlier, on the back of surging gas demand. Strong demand also made room for increased pipeline gas imports and domestic gas production.

Strong growth in China's gas consumption is expected to continue over the outlook period, driven by China's efforts to reduce air pollution and 'turn China's skies blue again'. China is aiming to raise the share of gas in the overall energy mix from 7.0 per cent in 2017 to a target range of 8.3–10 per cent in 2020, and to 15 per cent in 2030. In 2021, China's gas consumption is forecast to reach 364 billion cubic metres, up from around 280 billion cubic metres in 2018 (Figure 7.4).

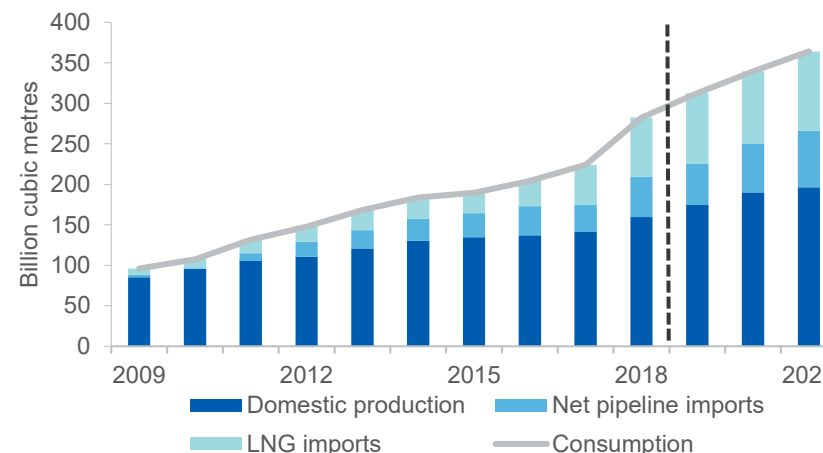
LNG is expected to play a major role in servicing rising Chinese gas demand: China's LNG imports are forecast to reach 72 million tonnes (98 billion cubic metres) in 2021. While both domestic production and pipeline imports are forecast to grow, they are not expected to keep pace with rising domestic demand.

China is targeting domestic gas production of 207 billion cubic metres in 2020, up 30 per cent from around 159 billion cubic metres in 2018. However, China faces challenges in lifting domestic output, including difficult geology, and could fall short of its 2020 production target.

China's pipeline gas imports are also expected to increase over the next few years. There are plans to expand the capacity of the Central Asia–China Gas Pipeline system from 55 billion cubic metres to 65 billion cubic metres by the end of 2019. The Power of Siberia pipeline from Russia to northern-eastern China is also scheduled for completion at the end of 2019. China is expected to import around 5 billion cubic metres of gas from Russia in the first full year of the pipeline's operation in 2020, but it will take until around 2025 for the imports to reach the pipeline's full capacity of 38 billion cubic metres.

The impact of China's decision to increase tariffs on US LNG from 10 per cent to 25 per cent from 1 June 2019 is discussed in Section 7.5.

Figure 7.4: China's gas consumption by source



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

South Korea's imports increased rapidly last year

South Korea was the world's third largest buyer of LNG in 2018, with LNG imports reaching an all-time high of 45 million tonnes. The rise was due to a sharp fall in nuclear power generation with reactors offline for both regular maintenance and unexpected downtime. South Korea's LNG imports fell by 15 per cent in the first four months of 2019, with demand constrained by a mild winter and the return of nuclear generation capacity to operation. The return of nuclear generation capacity is expected to drive a short-term fall in South Korea's imports to 41 million tonnes in 2019.

After 2019, LNG imports are expected to begin increasing again, reaching 46 million tonnes in 2021. South Korea's long-term plan is to shift its energy mix towards renewables and gas, and away from nuclear and coal. Against this backdrop, South Korea plans to close several more aging coal-fired power stations before 2022, and lowered taxes on LNG imports and raised taxes on thermal coal imports on 1 April 2019.

LNG demand to increase amongst other emerging Asian economies

Several other emerging Asian economies are expected to contribute to rising LNG demand. India's LNG imports are forecast to increase from 22 million tonnes in 2018 to 33 million tonnes in 2021. India is aiming to lift gas' share of the energy mix to 15 per cent by 2030 from the current 5 per cent. While India's domestic gas production is forecast to grow, it is not expected to keep pace with demand. India has considerable gas resources, but the commercial potential of these resources remains uncertain.

There is also significant scope for increased LNG demand in other emerging Asian economies, such as Pakistan, Bangladesh, Indonesia, Malaysia and Thailand. Pakistan is already a significant LNG buyer, with imports reaching an estimated 8 million tonnes in 2018, after the country experienced a domestic gas shortage. While individually these countries are relatively small importers of LNG, collectively they are expected make a substantial contribution to rising global LNG demand.

Europe to increase demand in the short term, before LNG imports decline

Europe's LNG imports are forecast to climb from an estimated 48 million tonnes in 2018 to 60 million tonnes in 2021. With European gas consumption expected to remain relatively flat, LNG imports are expected to be driven by declining gas production. Gas production in Europe has been declining since 2000, mainly due to resource depletion in the North Sea and efforts to reduce seismic activity at the Groningen gas field in the Netherlands.

LNG is expected to face increasing competition from pipeline gas, with the controversial Nord Stream II gas pipeline scheduled for completion in 2019. With a capacity of 55 billion cubic metres per annum (equivalent to around 40 million tonnes of LNG), Nord Stream II connects Russian gas fields to the EU pipeline network at Germany's Baltic coast.

7.5 World exports

A major expansion in global LNG production capacity is underway

The major expansion in global LNG supply capacity seen over the past few years still has some way to run. World supply capacity is expected to increase rapidly in 2019 and 2020, driven primarily by the US, and supported by a continued ramp-up in Australia (see section 7.6) and Russia. This growing supply capacity is expected to temper increases in LNG spot prices in Asia over this period.

The combined nameplate capacity of US LNG projects is on track to triple to around 70 million tonnes per annum (mtpa) in 2020. All six US plants are expected to be operational by the end of 2019, and production will continue to ramp up in 2020. This expansion in LNG infrastructure is expected to make the US the world's third largest LNG exporter, behind Australia (where nameplate capacity will soon reach 88 mtpa) and Qatar (where nameplate capacity is expected to remain at 77 mtpa for the next few years).

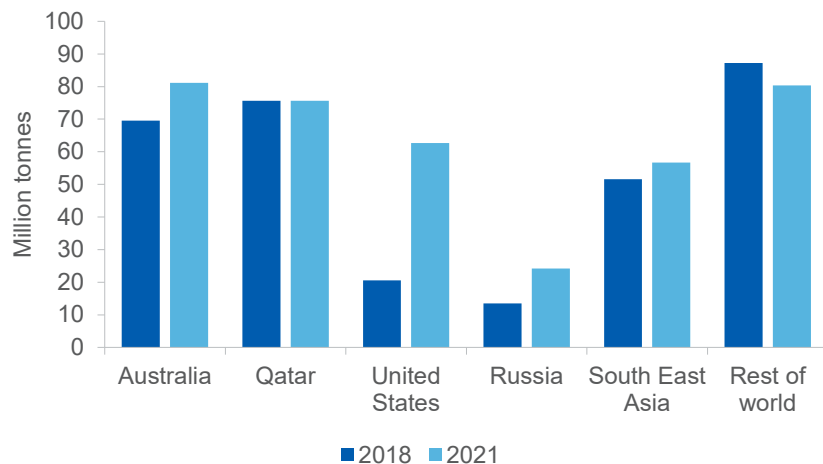
Russia's LNG export capacity is expected to reach 27 mtpa by the end of 2019. Yamal LNG — the country's second LNG project after Sakhalin — is currently in the process of ramping up production from its third train.

In 2021, growth in global supply capacity is expected to drop to its lowest level since 2013, with the only additions to capacity likely to be from new trains at existing projects in the US and Indonesia.

Qatar's LNG exports are projected to remain largely unchanged

Qatar was the world's largest LNG exporter in 2018, exporting an estimated 76 million tonnes of the liquefied fuel. According to International Energy Agency (IEA) data, Qatar's exports have ranged from 72–77 million tonnes a year since 2011, although other sources put the peak of Qatar's LNG exports at around 80 million tonnes. Qatar's LNG exports are forecast to remain around 76 million tonnes through to 2021. Qatar has plans to increase LNG production capacity by 43 per cent to 110 million tonnes in 2024, but the expansion is not due to be completed until after the end of the outlook period for this report.

Figure 7.5: LNG export forecasts



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

LNG has been caught up in US-China trade tensions

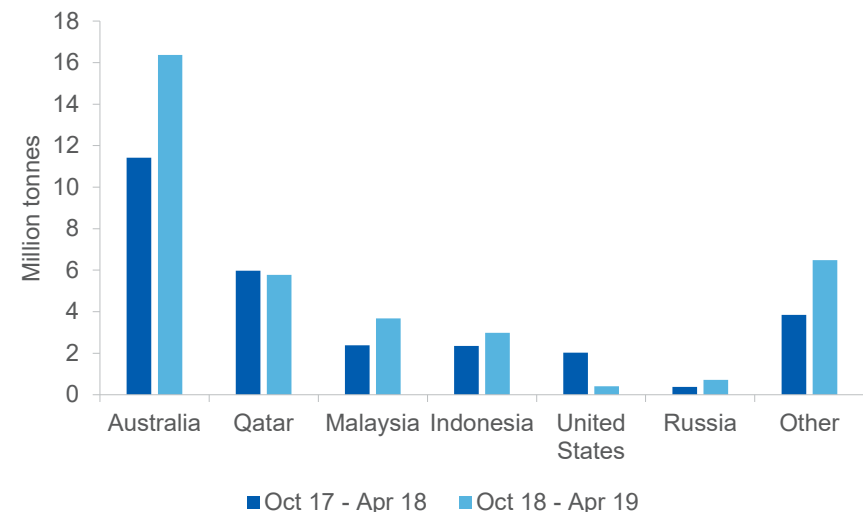
LNG trade has recently been caught up in trade tensions between China and the US. On 13 May, China announced that it would increase tariffs on US LNG imports from 10 per cent to 25 per cent effective from 1 June 2019, as part of its response to the US raising tariffs on US\$200 billion of Chinese goods.

To date, the 10 per cent tariff — which commenced on 24 September 2018 — has encouraged a reorganisation of trade flows; China has purchased more LNG from other sources, while US LNG exports have been directed to other markets (Figures 7.6 and 7.7). The effect of tariffs on short-term LNG prices appears to have been minimal, or has been swamped by other factors, such as rapidly increasing supply capacity in LNG markets.

Australia has accounted for the majority of the increase in China's imports since China imposed tariffs on US LNG in September 2018 (Figure 7.6). However, it is difficult to attribute this increase directly to the effect of tariffs, given China's rapidly growing LNG demand and the ramp up of new

Australian projects such as Wheatstone and Ichthys over the same period. Other countries, such as Malaysia and Indonesia, have also increased LNG exports to China since September 2018.

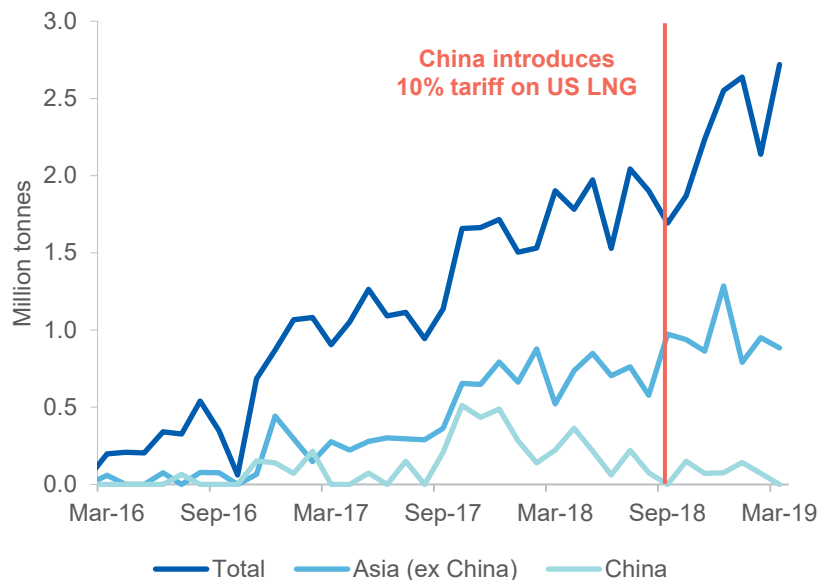
Figure 7.6: Year-on-year change in China's LNG imports since the imposition of tariffs on US LNG in September 2018



Source: Bloomberg

The impact of China lifting tariffs on US LNG to 25 per cent from June 2019 will become clearer in coming months, as data for the second half of 2019 comes in. It is possible that trade flows continue to reorganise around increased tariffs, with few apparent effects on the market. However, it may also become increasingly costly for China to bring in more LNG from non-US sources. Chinese LNG requirements are growing rapidly and the ramp up in low cost US LNG would have been a natural source of new supply for China. If non US-origin LNG is more costly for China to import, then tariffs could potentially have the effect of reducing China's LNG purchases.

Figure 7.7: US LNG exports by destination, monthly



Source: Energy Information Administration (2019)

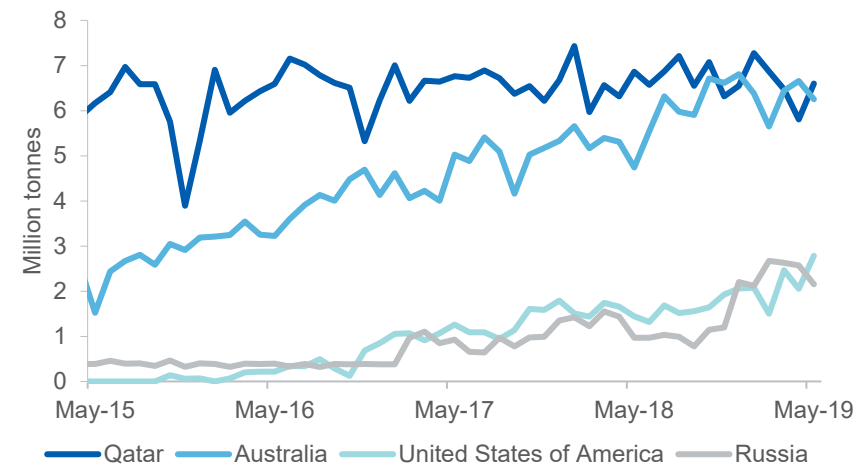
A longer-term risk is that escalating trade tensions discourage or delay final investment decisions (FIDs) for a second wave of US LNG projects. Given China is set to become the world's largest LNG buyer in the early 2020s, China will be looking for new sources of supply over the next few years, and trade tensions may deter Chinese buyers from investing in new US LNG projects. US exporter Cheniere Energy and Chinese buyer Sinopec have reportedly held off signing a 20-year supply deal for 2 million tonnes of LNG per year (starting in 2023) due to trade tensions. However, the possibility remains that China could commit to taking more US LNG in the event that trade tensions are resolved.

7.6 Australia

Australia's LNG exports are surging

Australia exported an estimated \$50 billion of LNG in 2018–19, up from \$31 billion in 2017–18. Higher export earnings have been driven by the recovery in oil prices (relative to 2017–18), and the ramp up of LNG exports, particularly from the Wheatstone and Ichthys LNG projects. Australia and Qatar continued to jostle for the title of the world's largest LNG exporter over the first five months of 2019. Australia took the lead in April as Qatar's exports dipped due to maintenance (Figure 7.8), before Qatar edged back past Australia in May.

Figure 7.8: Monthly LNG exports of key producers

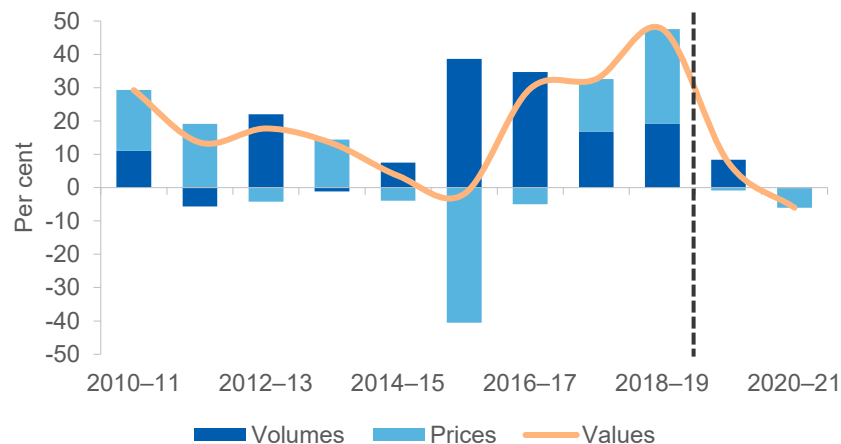


Source: Bloomberg (2019)

Australia's LNG export earnings to remain broadly stable

The value of Australia's LNG exports is forecast to increase to \$54 billion in 2019–20, driven by the ramp up in export volumes from Prelude and Ichthys (Figure 7.9 and 7.10). Shell shipped the first LNG cargo from its Prelude project on 11 June, and production is expected to ramp up during 2019–20. Train 2 at Ichthys is expected to come online during 2019.

Figure 7.9: Growth in Australia's LNG export earnings, contributions from volumes and prices



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

In 2020–21, the value of Australia's LNG exports is expected to fall back to \$50 billion, as oil-linked contract prices (at which most Australian LNG is sold) edge down and the exchange rate appreciates. LNG export volumes are expected to remain broadly stable in 2020–21 (Figure 7.9).

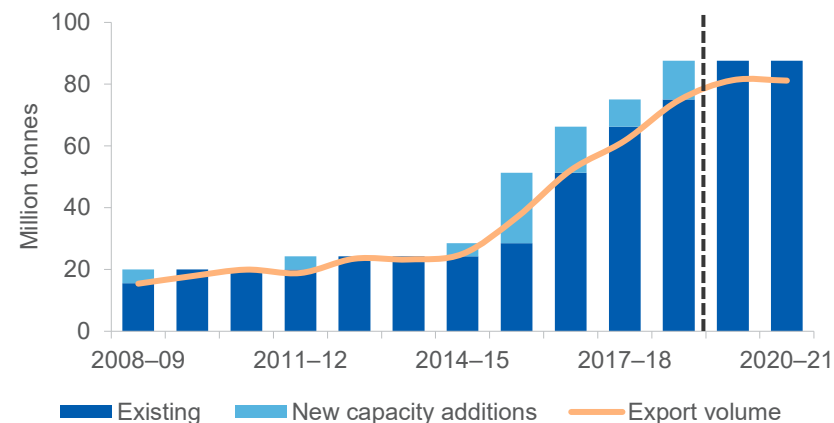
Australia could be the world's largest LNG exporter for the next few years

Australia is forecast to edge past Qatar as the world's largest LNG exporter (on an annual basis) when exports reach 78 million tonnes in 2019, and extend its lead in 2020 as exports climb to 81 million tonnes. However, the narrow difference between the projected exports of the two nations means that Australia overtaking Qatar is not a certainty. Indeed, that margin is likely to be particularly narrow in 2019.

The tussle for the title of the world's largest LNG exporter is further complicated by a lack of clarity around the precise level of Qatar's LNG exports. IEA data (used in this report) puts Qatar's exports at 75-76 million tonnes per annum over the past two years, while data from the International Group of Liquefied Natural Gas Importers (GIIGNL) has

exports at 77-78 million tonnes during this time, and shipping data suggests Qatar exported 79-80 million tonnes of LNG over the same period. During the mid-2020s, Australia is expected to be surpassed as the world's largest LNG exporter by both Qatar and the US, as new projects in both countries come online.

Figure 7.10: Australia's LNG exports and export capacity



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

Export earnings have been revised up

The forecast for Australian LNG export earnings has been revised up from the March 2019 *Resources and Energy Quarterly*. Export earnings are now expected to be \$1.1 billion higher in 2019–20, reflecting an upwards revision to the oil price forecast (see the *oil* chapter) and a downward revision to the AUD/USD exchange rate assumption.

An upward revision to prices has offset the impact of a downward revision to export volumes. ConocoPhillips confirmed in June that it expected the Darwin LNG plant to shut down for 1-2 years, starting between 2021 and 2023, when gas from the Bayu-Undan field is exhausted. While falling output at Darwin LNG was factored into the outlook for the March *Resources and Energy Quarterly*, production is now expected to decline at a faster rate.

Box 7.1: LNG price forecasting and Australia's eastern gas market

Movements in LNG spot prices in Asia have proven difficult to predict over the past few years. LNG spot prices rose over 2017 and 2018, during a time when many forecasters expected LNG markets to enter a period of deep overcapacity. Recently, just as discussion was turning to the potential for a supply crunch, spot prices fell sharply to near record lows.

In June 2019, the Oxford Institute for Energy Studies (OIES) published a paper *LNG spot price forecasting and the futures curve* that examined the accuracy of using the Asian LNG futures price — the current price of LNG for delivery at a specified future date — to forecast the Asian LNG spot price. The research compares the accuracy of futures prices against a 'naïve' or 'no change' forecast — a literature benchmark for testing forecasting methodologies — under which future spot prices are forecast to be equal to the most recent spot price.

The OIES finds that the Asian LNG futures price has displayed some predictive power relative to a naïve forecast for time horizons of around five months or less. For time horizons of six months or more, a naïve forecast outperforms a futures-based approach. According to the OIES, the predictive power of the futures curve may deteriorate due to declining liquidity (i.e. trading activity) in Asian LNG futures markets, which prevents the futures market from accurately reflecting participants' expectations of spot prices in the future. Alternatively, a growing risk premium — the return that investors require to take the offsetting position in a futures contract — may increasingly bias a futures-based forecast.

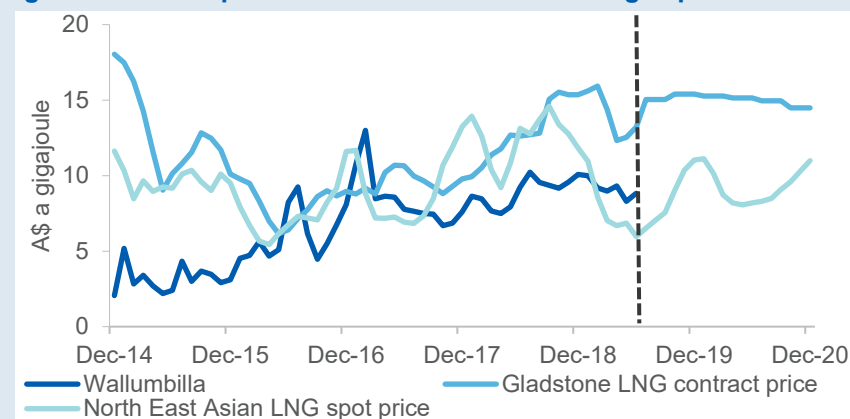
Following the start of LNG exports from Queensland in 2015, domestic gas prices in Australia's eastern gas market have become linked with LNG prices in Asia (Figure 7.11). According to the Australian Competition and Consumer Commission (ACCC), netbacks from Asian LNG spot prices — the spot price minus the costs of shipping and liquefaction — play an important role in shaping domestic gas prices, although they are not the only influence. In 2018, the ACCC began publishing an LNG spot price netback series to improve price transparency in the eastern gas market

and assist buyers in gas supply negotiations. However, it is worth noting that the precise relationship between domestic gas prices, LNG spot prices and oil-linked LNG contract prices (at which most Queensland LNG is sold) remains unclear (see the *gas* chapter from the December 2017 *Resources and Energy Quarterly*).

Figure 7.11 shows a domestic gas price — the price of gas at Wallumbilla (a gas trading hub in Queensland) — and LNG spot and oil-linked contract prices, and forecasts for LNG prices based on the Asian LNG futures curve and OCE oil price forecasts. In June 2019, prices at Wallumbilla were above Asian LNG spot prices, but below oil-linked contract prices.

Moving forward, the futures curve and OCE oil price forecasts suggest the divergence between LNG spot and oil-linked prices will continue. The question now is whether domestic gas prices fall towards LNG spot prices or rally towards oil-linked contract prices. Whatever the case, movements in domestic gas prices will have implications for industrial users, residential gas bills and electricity prices in Australia.

Figure 7.11: LNG prices and Australian domestic gas prices



Notes: LNG prices are Delivered Ex Ship (i.e. include the cost of shipping and insurance). The price of LNG sold on Gladstone oil-linked contracts is estimated at 14 per cent of the 3-month lagged JCC oil price plus shipping.

Source: Argus (2019); Australian Energy Market Operator (2019); Bloomberg (2019)

Table 7.1: Gas outlook

	Unit	2018	2019 ^f	2020 ^f	2021 ^f	Annual percentage change		
						2019 ^f	2020 ^f	2021 ^f
World								
JCC oil price ^a								
– nominal	US\$/bbl	72.9	70.0	72.4	70.5	-4.0	3.3	-2.6
– real ^h	US\$/bbl	74.6	70.0	70.7	67.4	-6.1	1.0	-4.7
Gas production	Bcm	3 813.5	3 920.3	3 981.8	4 032.0	2.8	1.6	1.3
Gas consumption	Bcm	3 827.6	3 929.9	3 992.4	4 061.6	2.7	1.6	1.7
LNG trade	Mt ^d	318.0	348.9	367.2	380.8	9.7	5.2	3.7
	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2018–19 ^f	2019–20 ^f	2020–21 ^f
Australia								
Production ^b	Bcm	120.3	139.9	145.0	144.9	16.3	3.7	-0.1
– Eastern market	Bcm	55.3	55.3	55.5	54.9	0.1	0.3	-1.0
– Western market	Bcm	63.8	82.1	81.0	81.0	28.7	-1.4	0.0
– Northern market ^c	Bcm	1.2	2.4	8.6	9.1	112.1	250.6	5.5
LNG export volume ^d	Mt	61.7	74.8	81.3	81.2	21.2	8.7	-0.2
– nominal value	A\$m	30,907	49,738	53,623	50,488	60.9	7.8	-5.8
– real value ^e	A\$m	31,523	49,738	52,366	48,120	57.8	5.3	-8.1
LNG export unit value ^g								
– nominal value	A\$/GJ	9.5	12.6	12.5	11.8	32.8	-0.8	-5.7
– real value ^e	A\$/GJ	9.7	12.6	12.2	11.2	30.2	-3.2	-8.0
– nominal value	US\$/MMBtu	7.8	9.6	9.5	9.3	23.3	-1.2	-2.1
– real value ^e	US\$/MMBtu	7.9	9.6	9.2	8.8	20.9	-3.5	-4.4

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 (bcm) of gas; **e** In 2018–19 Australian dollars; **f** Forecast; **g** 1 MMBtu is equivalent to 1.055 GJ; **h** In 2019 US dollars; **s** estimate.

Source: ABS (2019) International Trade in Goods and Services, Australia, 5368.0; Department of Industry, Innovation and Science (2019); Company reports; Nexant World Gas Model (2019)

Oil

Resources and Energy Quarterly June 2019



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

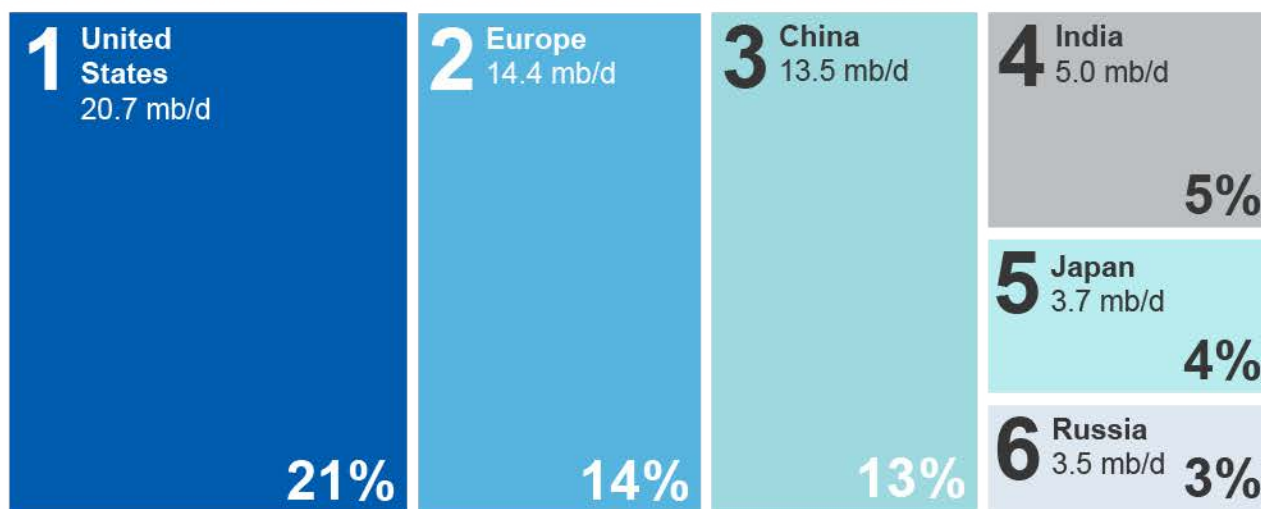


In the last 5 years the Brent spot price ranged from **US\$26 – US\$111** a barrel, and averaged **US\$60** a barrel

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

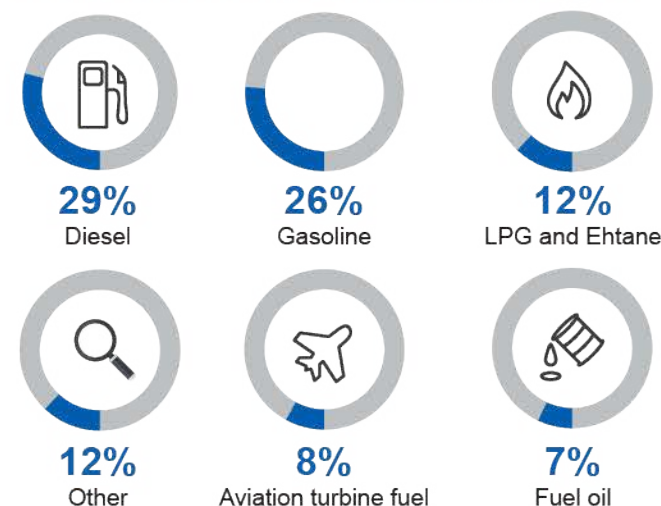


Key consumer markets of oil products (2019 forecast)



Note: Measured in million barrels per day.

World consumption of oil products



8.1 Summary

- After steady price increases over the first five months of the year, oil markets have entered a period of volatility in June 2019, reflecting uncertainty over global economic conditions and oil supply prospects.
- Australia's oil export volumes are forecast to peak during the outlook period, an additional benefit of new LNG projects coming online.
- Earnings from oil exports are forecast to continue their upward trend, rising from \$9.3 billion in 2018–19 to \$12.0 billion in 2019–20, before falling slightly to \$11.2 billion in 2020–21. The 2019–20 peak reflects expected volume growth, a higher expected oil price and the impact of a weak Australian dollar.

8.2 Prices

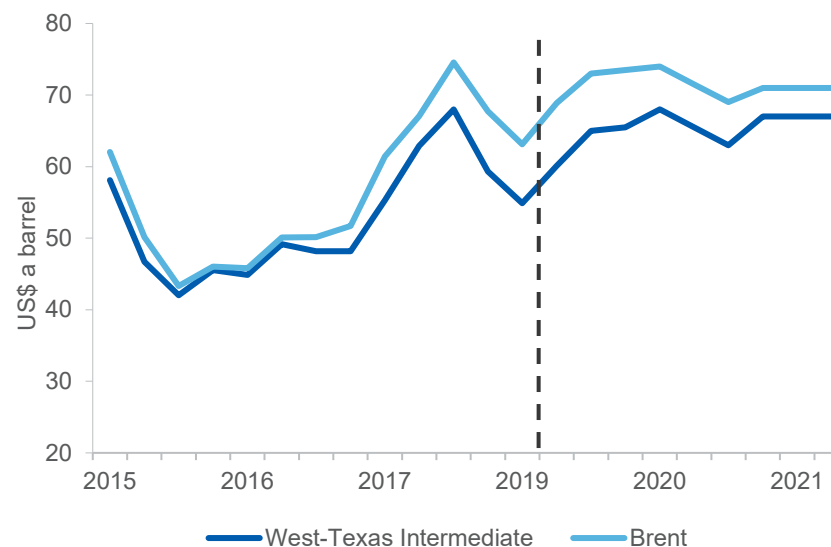
Demand and supply uncertainty in short term

The price of oil saw steady growth through the year until the middle of May, with the Brent crude benchmark rising from US\$53 a barrel on 1 January to peak at US\$74 on 16 May 2019.

Price growth was supported by the curtailment of supply under a production agreement, called the 'Vienna Agreement', between OPEC, Russia, Kazakhstan, Mexico and seven other countries (collectively referred to as 'OPEC+'). By May, over-compliance with that agreement, as well as unplanned outages in Venezuela and Iran, decreased total world oil production by more than twice as much as was expected, despite continued growth in US output (Figure 8.2).

From late May, oil prices plunged by 18 per cent. The change in sentiment stemmed from fears about the state of the global economy, heightened risks over US trade tension with China, Mexico and Iran, and data showing that US stockpiles of oil, gasoline and distillate had risen by 40 million barrels since the start of the year. Should OPEC+ members decide not to continue the Vienna Agreement in early July, oil prices could be lower than forecast.

Figure 8.1 Historical and forecast oil prices



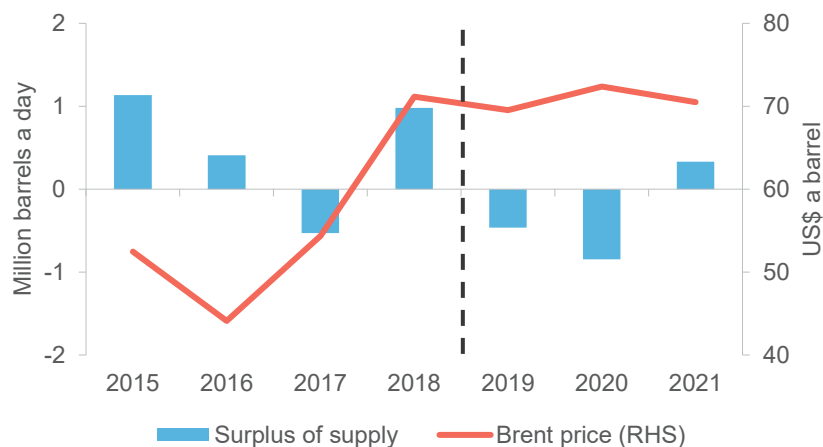
Source: Bloomberg (2019); Department of Industry, Innovation and Science (2019)

Recent attacks on tankers in the Gulf of Oman have caused the cost of shipping insurance to rise. A further heightening of tensions in the Middle East could drive oil prices higher.

The introduction of a low-sulphur bunker fuel standard for international shipping in 2020 may put upward pressure on the price of crude oils that refineries use to meet the standard, and downward pressure on crude grades typically used to make the (current standard) high sulphur fuel oil (Box 8.1).

Improving global economic growth in 2021 would help to support prices after markets adjust to the new shipping paradigm. The Brent crude benchmark price is forecast to average US\$71 a barrel over the outlook period (Figure 8.1).

Figure 8.2: Global oil supply, demand and price forecasts



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

8.3 World oil consumption

Global oil consumption growth is expected to increase at an average annual rate of 1.3 per cent over the outlook period, from 99 million barrels a day in 2018 to 103 million barrels a day in 2021. This is slower than the average growth of the last three years, reflecting the impacts of slower economic growth. Consumption growth is far less volatile than production.

Oil consumption to grow in emerging Asia and Australia

Non-OECD countries are expected to account for all of the growth in global oil consumption over the outlook period, with consumption forecast to reach 55 million barrels a day in 2021, up from 51 million in 2018.

Consumption in China is expected to reach 14 million barrels a day in 2021, increasing at an average annual rate of 2.8 per cent. In India, the 2021 forecast is 5.4 million barrels a day, with 4.2 per cent annual growth.

By contrast, consumption by the OECD nations is expected to remain steady at 48 million barrels a day over the outlook period, as energy efficiency improves. While Australia is part of the OECD, its consumption

of oil products over the past decade has more closely resembled the non-OECD trend. Australia consumed 1.1 million barrels of oil in 2018. In the absence of policy change, Australia's consumption of oil products is expected to grow at an annual rate of 1.6 per cent to 2021.

Since the March 2019 *Resources and Energy Quarterly*, the forecast for global oil consumption has been revised down by 0.2 million barrels a day due to continued trade tensions and a weakening global economy.

Box 8.1: Higher fuel quality standards to reduce shipping pollution

On 1 January 2020, new International Maritime Organisation shipping fuel quality standards come into force which will reduce air pollution, reshape the global oil refining sector and may disrupt oil markets.

From this date, shipping will run on bunker fuel with a maximum 0.5 per cent sulphur content — a major change to current standards which allow up to 3.5 per cent sulphur. Rather than switching to low-sulphur fuel, some shipping operators may choose to switch to natural gas or to install emission scrubber equipment. All options are likely to increase the cost of shipping, but current bunker fuels cause shipping emissions to be highly toxic and a major source of air pollution.

The change is not expected to affect the total amount of oil consumed, but will likely alter the composition of demand. As up to 3 million barrels a day of fuel demand is expected to shift from high-sulphur fuel oil to low-sulphur fuels, some sour/heavy crude oil grades currently used to produce high sulphur fuel oil will likely see demand decline. As new and reconfigured refineries ramp up to meet the new standard, sweet light crudes such as the Brent and WTI benchmarks are likely to be in greater demand.

Adjustment in the global oil refining industry will require investment, and will take time. Volatility is likely in the meantime, with some analysts estimating a temporary increase in the Brent benchmark price of up to US\$7 a barrel for part of 2020.

Sources: International Energy Agency, 2019, *Oil 2019: Analysis and Forecasts to 2024*; S&P Global Platts, 2019, *Turning Tides: The Future of Fuel Oil after IMO2020*.

8.4 World oil production

Despite US growth, world production has been constrained by the production-limiting efforts of OPEC+ and the impact of US sanctions.

Since the March 2019 *Resources and Energy Quarterly*, the immediate supply outlook has deteriorated materially, with forecast 2019 production levels revised down from 100.7 to 100.0 million barrels a day. Total output growth is forecast to remain muted through 2020 and to recover strongly during 2021, with production at 104 million barrels a day (Figure 8.3).

The OPEC+ supply agreement required each participant to reduce their output against an October 2018 benchmark, and the following analyses changes since that month for consistency. In the seven month period from October 2018 to May 2019, global oil production decreased by more than OPEC+ expected.

OPEC+ cuts production and unplanned outages materialise

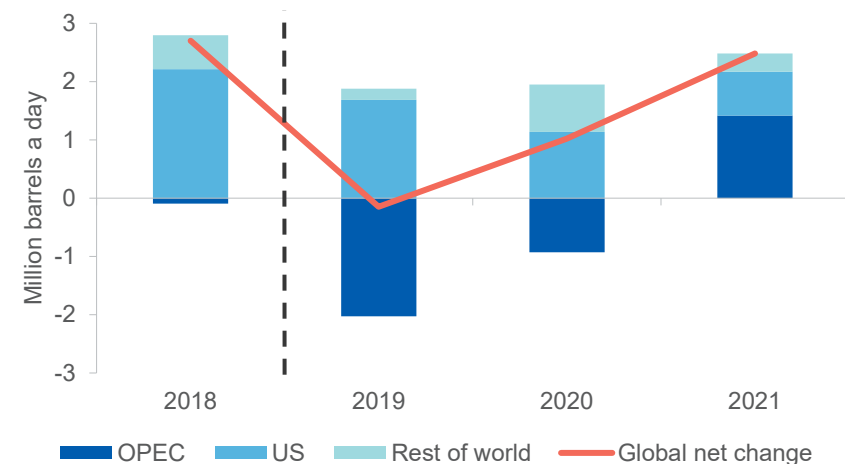
By the end of May 2019, the change in OPEC+ total oil (crude and natural gas liquids) production was –2.8 million barrels a day compared with October 2018. This large reduction in output was the combination of voluntary cuts and involuntary outages and represents a substantial 5 per cent loss of supply from this group of 24 producer nations.

Voluntary cuts (comparing October 2018 to May 2019 production) were achieved by key nations Saudi Arabia (–0.9 million barrels a day), Russia (–0.3 million barrels a day) and the United Arab Emirates (–0.1 million barrels a day). Russian voluntary production cuts commenced a little later than the Persian Gulf producers due to weather conditions, and continued falling through May and June. Stabilisation of Russian output is expected by July as contamination in the Druzhba pipeline is progressively resolved.

Involuntary cuts have mainly affected the OPEC members exempt from the Vienna Agreement: Iran (–0.9 million barrels a day) and Venezuela (–0.5 million barrels a day). The outlook for these producers is worsening.

Iran is the 6th largest producer of oil in the world. Since May 2019, as part of its ‘maximum pressure’ campaign against Iran, the US has promised to

Figure 8.3: Annual change in forecast world oil production by region



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

impose penalties on parties who buy Iranian oil — including those in countries previously granted exemptions from US sanctions. With Iran’s output in recent years providing over 4 million barrels a day, a major fall risks upward pressure on oil prices. The US has indicated an expectation that OPEC will increase output to make up for lost Iranian supply.

Venezuela also faces US sanctions, along with a political and economic crisis which has crippled the country’s oil production. Venezuela has the world’s largest proven oil reserves and in the decade to 2015 its oil production averaged almost 3 million barrels a day. Production has fallen every year since 2015, the decline accelerated in 2018, and is now below 1 million barrels a day, with improvement unlikely over the outlook period.

OPEC+ is expected to meet in early July to consider a new production agreement. At the time of writing, it is expected that OPEC+ will agree to hold production at current levels, effectively extending the Vienna Agreement to the end of 2019. This expectation is supported by the current weakness in oil prices, the declining world economic outlook, the impact of geo-political factors, and the rate of increase in US shale output

(for more detail on US oil production, see Box 8.1 in the March 2019 *Resources and Energy Quarterly*, on page 75).

OPEC output to 2021 is forecast to remain below 2018 levels, with Saudi Arabia's return to normal production and a slow recovery of Iran's output. Venezuela's production is expected to take longer to recover.

Middle East producers face additional risks relating to the escalating threat of sabotage, and of military conflict. US forces were deployed to the region in early May, and a number of oil tankers were damaged in the Gulf of Oman on 12 May and 13 June 2019. The US stated it believed Iran to be responsible for the attacks on tankers.

Rapid US growth continues

US oil output increased by 0.7 million barrels a day between October 2018 and May 2019. The annual growth rate of US output is expected to be 11 per cent through 2019 and the country is expected to dominate supply growth over the outlook period on the back of a long period of investment in exploration, wells and infrastructure (Figure 8.3).

US production is forecast to reach 19.1 million barrels a day in 2021, up from 15.5 million barrels a day in 2018.

8.5 Australia's production and trade

Export earnings grow strongly on output surge

Higher crude and condensate export volumes, higher prices and a weak Australian dollar combined to drive export earnings up to an estimated \$9.3 billion in 2018–19, a 34 per cent increase on the previous financial year.

The outlook for crude and condensate remains strong, with production forecast to increase at an average annual rate of 10 per cent, from 338,000 barrels a day in 2018–19 to 409,000 barrels a day in 2020–21.

Annual export earnings from crude and condensate are forecast to rise from \$9.3 billion in 2018–19 to \$12.0 billion in 2019–20, due to rising export volumes and higher prices (Figure 8.4).

Compared with the previous year, a 51 per cent increase in condensate production — primarily from new offshore LNG projects — more than offset the ongoing decline in crude production (Figure 8.5). The effects of this compositional change in oil production is illustrated in Box 8.2.

Box 8.2: Australia exports oil to the Middle East

The composition of Australia's oil exports is changing, with condensate exports growing strongly this year while crude oil exports have declined. For the most part, Australian exports are destined for Asian refineries and petrochemical processors — Singapore and Thailand are typically the major buyers.

However in the March quarter 2019, Australian producers exported 330.3 million litres of condensate to the United Arab Emirates (UAE). This was roughly one-tenth of Australia's total petroleum exports over the quarter.

Until now, the UAE has been exclusively a source of imported crude oil for Australia. Our refineries currently import 83 per cent of the crude oil they process, and the UAE is our second biggest source of refinery feedstock. Since different forms of oil are used by different types of facility to produce a range of end products, this relationship could continue: Australia importing crude oil from the UAE while the UAE imports condensate from Australia.

In 2018–19, Australia is estimated to have exported 257,000 barrels a day, or 76 per cent of its crude and condensate production.

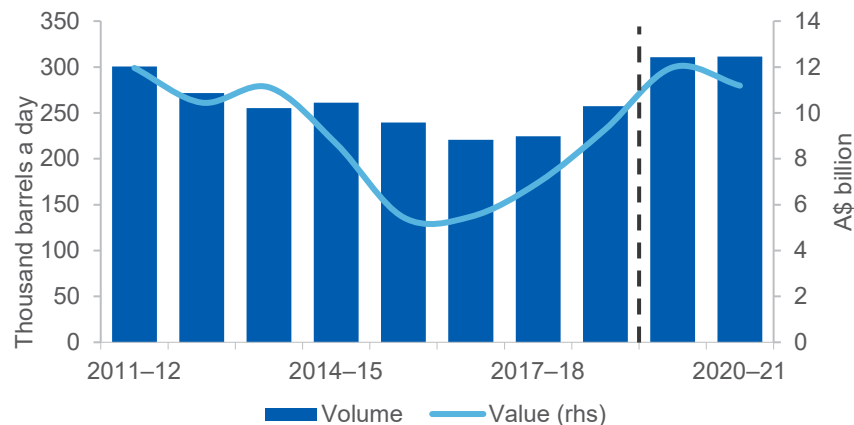
Source: Australian Petroleum Statistics (2019).

Crude oil production hits the bottom

The long decline in domestic crude oil production appears to have bottomed in 2018–19, at an estimated 109,000 barrels a day. Crude production in 2020–21 is forecast to be 24 per cent higher than this.

In Carnarvon, at Woodside's Vincent and Enfield fields, production has temporarily ceased in preparation for the Greater Enfield expansion —

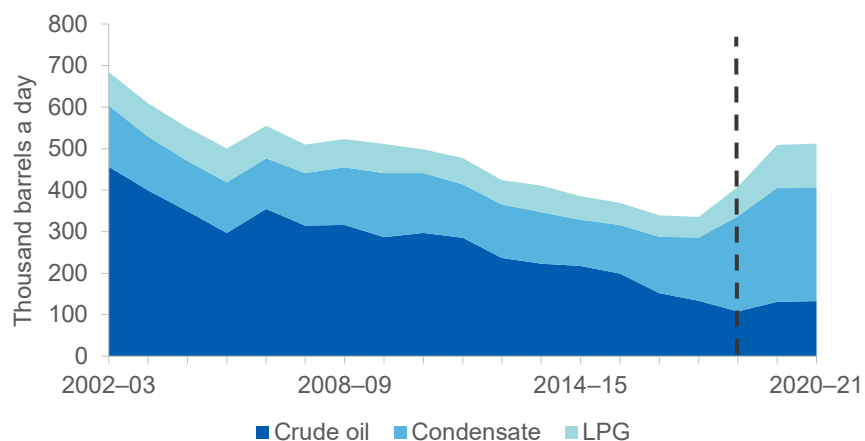
Figure 8.4: Australia's annual oil exports



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

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

Figure 8.5: Composition of Australia's petroleum production



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

which is expected to come online in 2019–20. Santos' offshore Mutineer Exeter ceased operating last year. BHP's Pyrenees operations are back online, after planned maintenance in 2018, but production levels since then have been below expectations. In Bonaparte, Jadestone's Montara field restarted in January after maintenance, and almost doubled its production in the March quarter 2019, year-on-year.

Condensate and LPG production up strongly

Condensate output is forecast to grow 10 per cent a year, from 230,000 barrels a day in 2018–19 to 274,000 barrels a day in 2020–21.

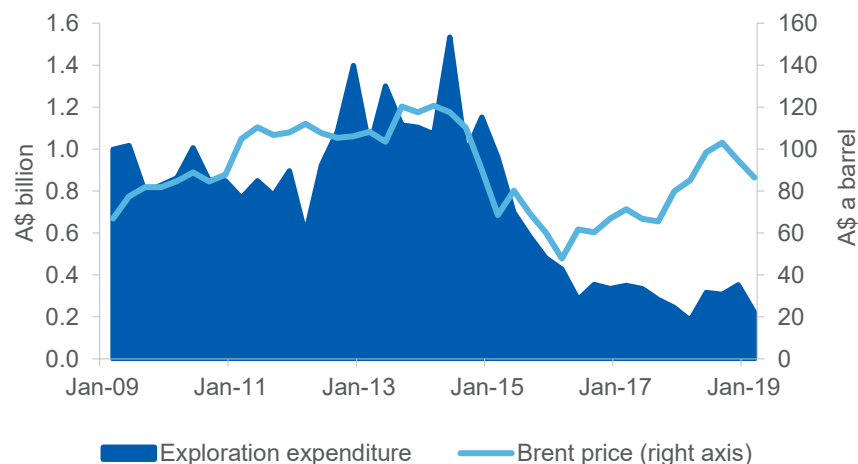
In late 2018, new condensate production came online off the Western Australian coast — in the Browse Basin — with the start-up of Train 1 at INPEX's Ichthys facility. Ichthys has a nameplate capacity of 100,000 barrels a day of condensate, and has ramped up quickly, producing at over 50 per cent of capacity in the March quarter 2019. Also in the Browse Basin, Shell's Prelude facility has commenced operations, producing around 25 per cent of its nameplate capacity of 36,000 barrels a day. The output of both is expected to increase further through 2019.

As a result of Ichthys coming online, LPG production in the March quarter 2019 was higher year-on-year despite Esso's Gippsland Basin joint venture in the Bass Strait producing only half its usual output. By 2020–21, Australian LPG output is expected to reach 106,000 barrels a day — an annual growth rate of 25 per cent since 2018–19.

Exploration expenditure low, but trend could be turning

Petroleum exploration expenditure was \$223 million in the March quarter 2019, up 21 per cent year-on-year. Exploration expenditure has fallen for over a decade, and this quarter's result provides a preliminary indication that 2018 may have been the bottom. High oil prices in Australian dollar terms (Figure 8.6) may be motivating a modest return of confidence in the oil and gas industry.

Figure 8.6: Australian petroleum exploration and oil price



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

Australia's refinery production steady

Australia's refinery production was 498,000 barrels a day in the March quarter 2019, unchanged from 2018. To meet Australian demand, an estimated 60 per cent of refined product was imported in 2018–19, including 70 per cent of diesel and 36 per cent of automotive gasoline.

Australian refinery production is expected to average around 492,000 barrels a day over the outlook period to 2020–21. Imports of refined fuels are likely to increase to meet expected growth in Australian consumption.

Revisions to the outlook

Australia's forecast oil export earnings have been revised down by \$145 million in 2018–19 and up by \$650 million in 2019–20, compared to the forecast in the March 2019 *Resources and Energy Quarterly*. Both periods have slightly lower expected export volumes and the 2019–20 revision reflects temporarily higher forecast oil prices as a result of new shipping fuel standards, and weak world production growth.

Table 8.1: Oil outlook

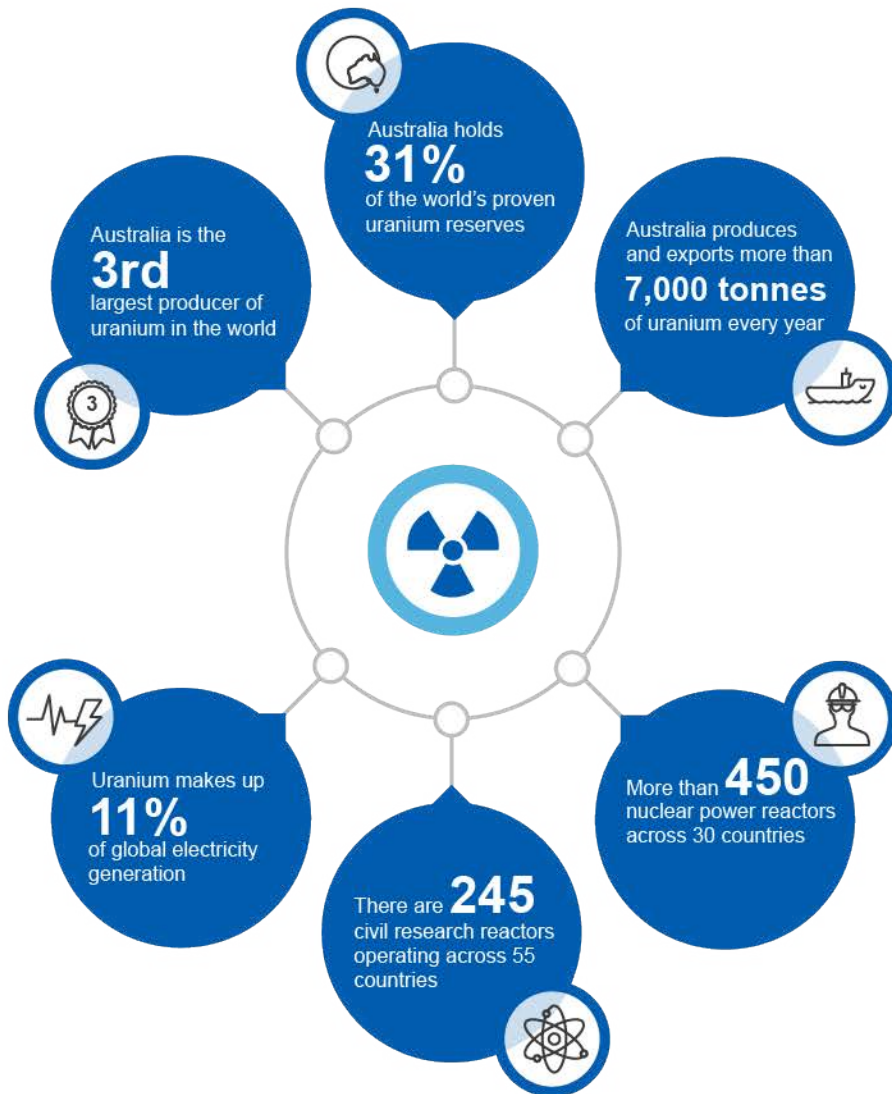
World	Unit	2018	2019 ^f	2020 ^f	2021 ^f	Annual percentage change		
						2019 ^f	2020 ^f	2021 ^f
Production ^a	mb/d	100.1	100.0	101.0	103.5	-0.1	1.0	2.5
Consumption ^a	mb/d	99.1	100.4	101.8	103.1	1.3	1.4	1.3
WTI crude oil price								
– Nominal	US\$/bbl	65.1	61.3	66.4	66.5	-5.8	8.3	0.2
– Real ^b	US\$/bbl	66.6	61.3	64.9	63.6	-7.9	5.8	-2.0
Brent crude oil price								
– Nominal	US\$/bbl	71.2	69.5	72.4	70.5	-2.3	4.1	-2.6
– Real ^b	US\$/bbl	72.8	69.5	70.7	67.4	-4.4	1.7	-4.7
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2018–19 ^f	2019–20 ^f	2020–21 ^f
Crude and condensate								
Production ^a	kb/d	286	338	409	409	18.3	21.0	0.1
Export volume ^a	kb/d	225	257	311	311	14.5	20.8	0.2
– Nominal value	A\$m	6,958	9,288	11,984	11,186	33.5	29.0	-6.7
– Real value ^g	A\$m	6,994	9,288	11,703	10,662	30.9	26.0	-8.9
Imports ^a	kb/d	386	386	354	352	-0.2	-8.3	-0.6
LPG production^{ac}	kb/d	50	70	103	106	41.6	46.9	2.7
Refined products								
– Refinery production ^a	kb/d	494	499	487	485	1.1	-2.5	-0.4
– Export volume ^{ad}	kb/d	18	16	17	12	-8.9	3.7	-24.9
– Import volume ^a	kb/d	645	649	662	697	0.7	1.9	5.4
– Consumption ^e	kb/d	1,040	1,072	1,090	1,105	3.0	1.6	1.4

Notes: **a** The number of days in a year is assumed to be 365, and a barrel of oil equals 158.987 litres; **b** In 2019 calendar year US dollars; **c** Primary products sold as LPG; **d** Excludes LPG; **e** Domestic sales of marketable products, including imports; **f** Forecast; **g** In 2018–19 financial year Australian dollars; **s** Estimate.

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

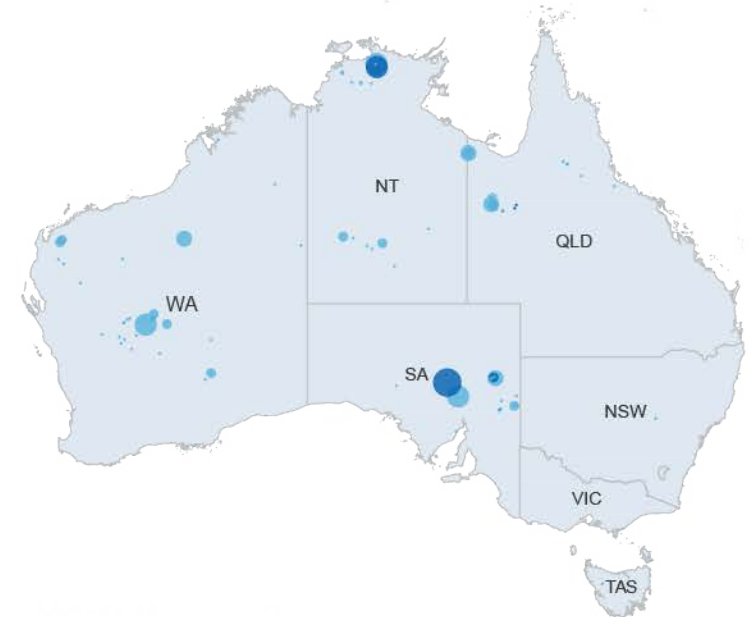
Uranium

Resources and Energy Quarterly June 2019

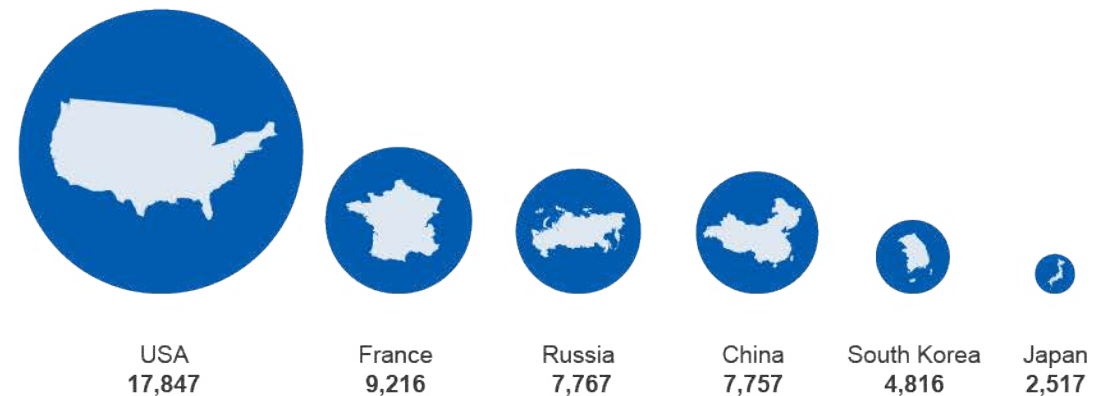


Major Australian uranium deposits (tonnes)

- <2,967
- 2,968–9,762
- 9,763–17,571
- 17,572–59,338
- >59,339
- Deposit
- Operating mine



Key consumer markets (tonnes)



9.1 Summary

- Uranium spot prices have stabilised after substantial gains in late 2018. Prices remain low, but higher demand and flat or falling output is expected to push them up to above US\$37 a pound by 2021.
- Uranium production in Australia is expected to decline over the outlook period, as output winds down at the Ranger mine ahead of its scheduled closure at the start of 2021.
- Australia's uranium export earnings are expected to remain roughly steady over the outlook period, albeit with a fall in 2020 as output ceases from Ranger.

9.2 Prices

Uranium prices have stabilised, but with potential to rise further

Uranium prices have flattened out in recent months, after a strong rise in the second half of 2018. Prices bottomed out in 2017, and began to recover only after large cuts in output from producers in Kazakhstan and Canada. Kazatomprom — which dominates Kazakh output — cut production by 20 per cent, effectively reducing global supply by 8 per cent. Cameco shut down its large McArthur River mine entirely, reducing global production by a further 11 per cent.

Since these supply cuts took effect, prices have shifted to between US\$25 and US\$28 a pound. Kazatomprom has mooted further cuts in output in coming years. Supply constraints in conjunction with rising demand from new power plants in Asia and Eastern Europe should bring about a slow lift in prices (Figure 9.1), though large inventories are likely to moderate price pressures.

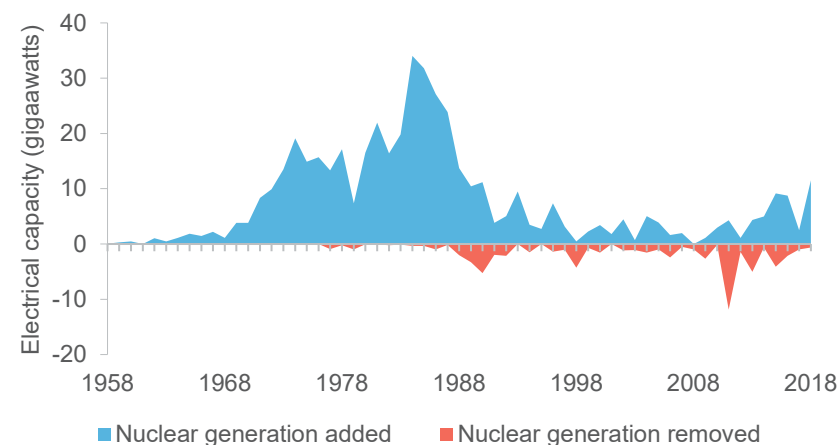
Price pressures may become much greater in the future. A number of mines, including several large projects in Africa, were postponed during the period of depressed prices. Rising demand (Figure 9.2) and a deferral of new supply could lead to a supply crunch by the mid-2020s. The longer-term outlook and history for uranium is examined in more detail in this edition's *uranium special topic*.

Figure 9.1: Uranium price outlook



Source: Cameco Corporation (2019) Uranium Spot Price; Ux Consulting (2019) Uranium Market Outlook

Figure 9.2: World nuclear power generation



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

9.3 World consumption

Nuclear power growth continues across Asia

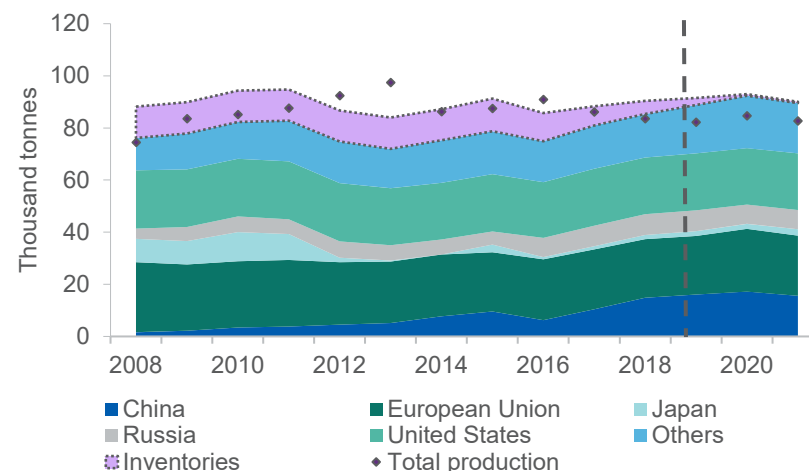
Chinese nuclear deployments have recently slowed significantly, with five reactors expected to be constructed in China in 2019 — around half the number connected in 2018. These include unit 5 of the Fuqing nuclear power plant, which began undergoing hydrostatic tests in April, bringing the unit into its commissioning phase 50 days ahead of schedule. Reactor construction processes in China have become increasingly efficient, with construction times for Fuqing 5, Hongyanhe 5 and Fangchenggang 3 all averaging around four years.

Construction milestones have also been reached in other countries. In South Korea, unit 4 of the Shin Kori power plant was grid-connected in late April 2019. Russia's twin KLT-40 reactor system — the first floating reactor capable of connecting to external sources — passed final tests and is set to be granted an operating licence in July. The system contains twin reactors and will be capable of ocean travel, making it able to connect to power grids around the country.

The Russian government also granted final regulatory approval to unit 2 of the Novovoronezh II nuclear power plant in April, enabling it to start supplying electricity in May. The United Arab Emirates recently connected its first reactor, beginning a construction wave expected to produce 6GWh of nuclear power over 10 years. Finland recently granted its first licence for a new nuclear power plant since 1979. The reactor at Olkiluoto will be among the largest reactors ever built, supplying 1600 Megawatts electric, or around 15 per cent of the country's total electricity supply.

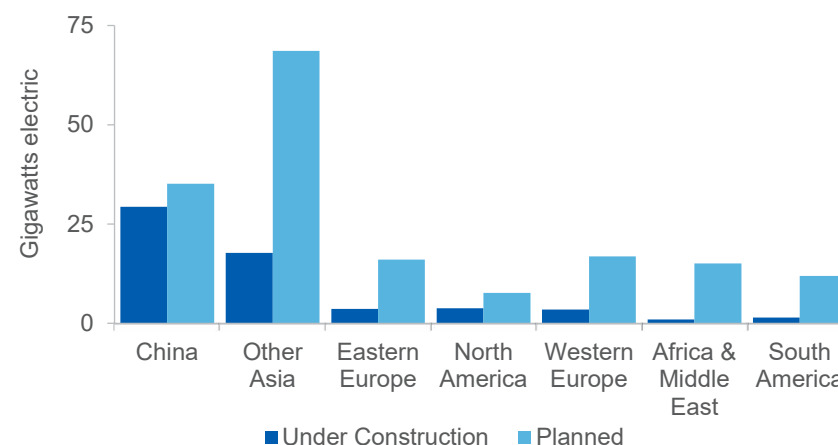
Other countries have begun to move towards commencement of nuclear constructions. Uzbekistan recently begun a site selection process for its first nuclear plant. In Egypt, the Nuclear Power Plants Authority has been granted approval to construct four units at its El Dabaa site. Brazil has released an energy plan which outlines goals out to 2050: the plan requires consideration of nuclear plants, including modular Generation IV reactor technology. The Brazilian government has also confirmed its commitment to progressing construction of the large Angra 3 project.

Figure 9.3: World uranium consumption and inventory build (U3O8)



Source: International Energy Agency (2019); World Nuclear Association (2019); Ux Consulting (2019)

Figure 9.4: New nuclear capacity



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

Development of small modular reactors passed a milestone in April, with the first licence application for a small modular reactor submitted to the Canadian Nuclear Safety Commission. The application was lodged by Global First Power and includes a proposal for a reactor construction plant in Ontario. This plant would be capable of producing pre-assembled reactors on a production line for shipment around the world.

The US Senate has sought to support this technology through its recently introduced Nuclear Energy Leadership Act. This would authorise long-term power purchase agreements for nuclear energy, and establishes a pilot program to enable them. It also sets goals and a strategic plan for advanced reactor research and development, provides for additional nuclear research in universities, and updates regulations to better support emerging technology. The progression of this technology creates significant long-term potential for further growth in uranium demand.

Other countries have revisited earlier plans to reduce nuclear generation in their grids. A draft bill presented to the French Council of Ministers seeks to delay France's scale-down of nuclear power. France previously proposed a reduction of nuclear power from 50 per cent of electricity generation to 35 per cent by 2025; the new bill would defer this goal to 2035. The phase-out of nuclear power would have required the injection of significant Russian gas into the French power grid, reducing French energy independence and adding significantly to carbon emissions. The new bill would change the current carbon pathway — for a 75 per cent cut in greenhouse gas emissions from 1990 levels by 2050 — to one which leaves France fully carbon neutral by 2050.

Japan re-opened five reactors in 2018 (Genkai 3 and 4, Ohi 3 and 4, and Ikata 3), bringing its total operating units to nine. However, nuclear power in Japan continues to face challenges, with Japan's nuclear regulation authority recently announcing that operations would be halted at reactors which miss deadlines on installing new counterterrorism measures. At the time of writing at least five reactors are lagging in their schedules.

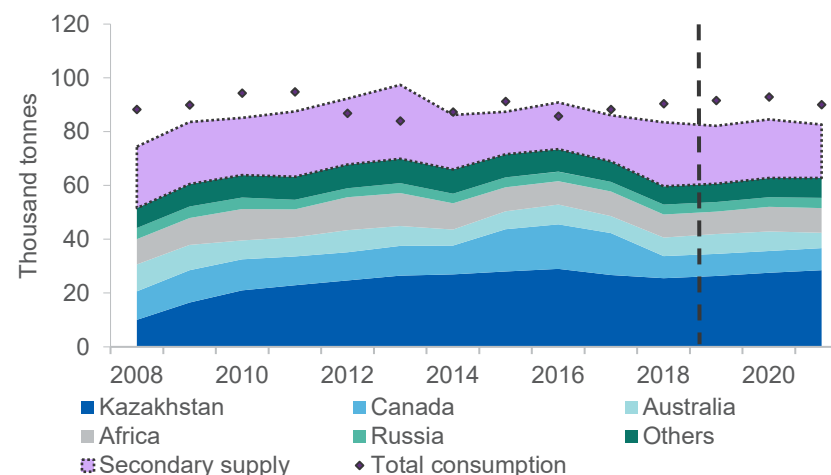
Overall reactor requirements are expected to grow steadily over time (Figure 9.3), rising from 85,300 tonnes in 2018 to 89,500 tonnes by 2021.

9.4 World production

Conditions for uranium producers are belatedly improving

Uranium production continues to face constraints (Figure 9.5). Kazatomprom — the world's largest uranium supplier — is expected to continue progressing its plan to reduce output by 20 per cent by 2020.

Figure 9.5: World uranium production and secondary supply (U3O8)



Source: Ux Consulting (2019) Uranium Market Outlook; World Nuclear Association (2019)

Uranium production in the US fell by more than 80 per cent between the last quarter of 2018 and the first quarter of 2019 — among the sharpest cuts on record. However, some prospects are emerging for a recovery in US output, with Energy Fuels' two Utah mines being refurbished and prepared for commercial production. Further progress will likely depend on the company's success in negotiating uranium sales contacts.

Uranium output from Iran is rising in the wake of the cancellation of the Iran nuclear deal, which previously restricted uranium production in the country.

In aggregate, global mine production is expected to edge up from 59,700 tonnes of U3O8 in 2018, to 62,700 tonnes by 2021.

9.5 Australia

Low prices have sharply reduced uranium exploration

Only \$2.3 million was invested in uranium exploration in Australia in the March quarter. This is down from \$3.6 million in the December quarter. Over the year to date, \$11 million has been spent: virtually unchanged from the same period a year ago, but well below the 10-year average.

The closure of Ranger will drive a decline in production by 2021

The Ranger uranium mine, operated by Energy Resources Australia, remains on schedule to close in January 2021, as required by its lease conditions. Closure of this mine will reduce Australian output significantly.

Cameco Australia's Yeelirrie uranium mine in Western Australia was granted environmental approval in April by the Commonwealth Department of Environment and Energy. This follows a provisional approval from the Western Australian state government; at the time of writing final approval from the state government remains pending.

The Yeelirrie mine sits on one of Australia's biggest uranium deposits, and would be capable of producing around 3,850 tonnes of U₃O₈ each year for around fifteen years. The mine will be 9 kilometres long, 1.5 kilometres wide and 10 metres deep. Approval follows a two-year environmental assessment process, with the company required to take measures to reduce potential impact on stygofauna (creatures which dwell in groundwater) unique to the site. The mine will take around five years to start producing, and the company has advised that any commencement to the next stage would depend on 'market conditions'.

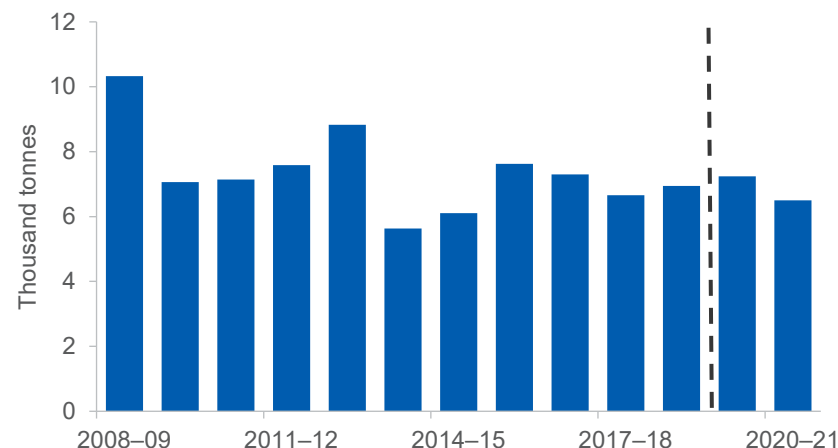
Conditions for exporters remain difficult, but price growth should help

Following the trajectory of production, export volumes are expected to decline from 2019–20. Price growth is expected to slightly offset this fall over the outlook period (Figures 9.6 and 9.7).

Revisions to the outlook

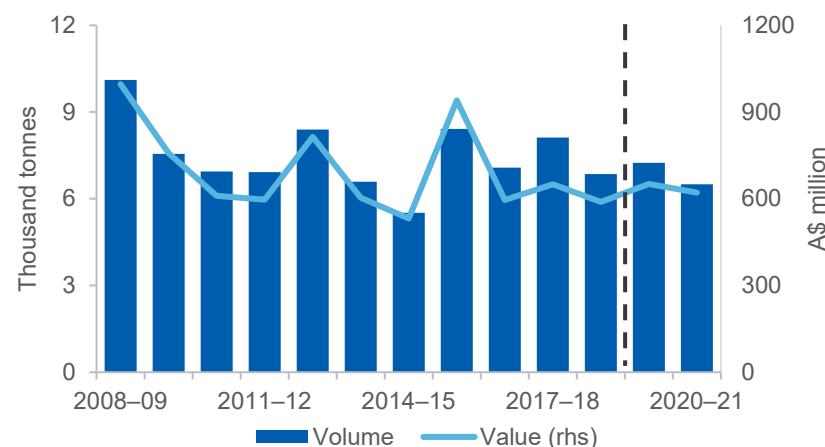
Australia's forecast uranium export earnings for 2018–19 and 2019–20 remain largely unchanged from the previous forecast.

Figure 9.6: Australia's uranium production



Source: BHP (2018); Operational Review, Department of Industry, Innovation and Science (2019); Energy Resources of Australia (2018); ASX Announcements — Operations Review; company media announcements (2019)

Figure 9.7: Australia's uranium exports



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

Table 9.1 Uranium outlook

World	Unit	2018	2019 ^f	2020 ^f	2021 ^f	Annual percentage change		
						2019 ^f	2020 ^f	2021 ^f
Production	kt	59.7	60.6	62.8	62.7	1.6	3.6	-0.1
Africa ^b	kt	8.6	8.3	9.1	9.1	-3.2	9.5	0.0
Canada	kt	8.2	8.2	8.2	8.2	-0.8	0.0	0.0
Kazakhstan	kt	25.5	26.4	27.5	28.5	3.7	4.3	3.6
Russia	kt	3.7	3.7	3.7	3.8	0.0	0.0	3.1
Consumption	kt	85.3	88.8	92.4	89.5	4.1	4.0	-3.1
China	kt	14.8	16.1	17.2	15.6	8.5	7.1	-9.6
European Union 28	kt	22.5	22.5	24.1	23.1	0.0	7.2	-3.9
Japan	kt	1.6	1.9	1.9	2.4	18.8	0.0	26.0
Russia	kt	8.0	8.0	7.4	7.4	-0.3	-6.7	-0.4
United States	kt	21.8	21.8	21.7	21.8	0.0	-0.7	0.6
Spot price	US\$/lb	24.1	27.5	33.8	37.5	13.8	23.1	11.1
real ^c	US\$/lb	24.7	27.5	33.0	35.9	11.3	20.3	8.7
Australia	Unit	2017–18	2018–19^s	2019–20^f	2020–21^f	2018–19^s	2019–20^f	2020–21^f
Mine production	t	6,654	6,943	7,240	6,500	4.3	4.3	-10.2
Export volume	t	8,118	6,857	7,240	6,500	-15.5	5.6	-10.2
– nominal value	A\$m	650	589	651	621	-9.4	10.6	-4.6
– real value ^d	A\$m	663	589	636	592	-11.2	8.0	-6.9
Average price	A\$/kg	80.0	85.9	89.9	95.6	7.3	4.7	6.3
– real ^d	A\$/kg	81.6	85.9	87.8	91.1	5.2	2.3	3.7

Notes: **b** Includes Niger, Namibia, South Africa, Malawi and Zambia; **c** In 2019 US dollars; **d** in 2018–19 Australian dollars; **f** forecast; **s** estimate.

Source: Australian Department of Industry, Innovation and Science (2019); Cameco Corporation (2019); Ux Consulting (2019) Uranium Market Outlook

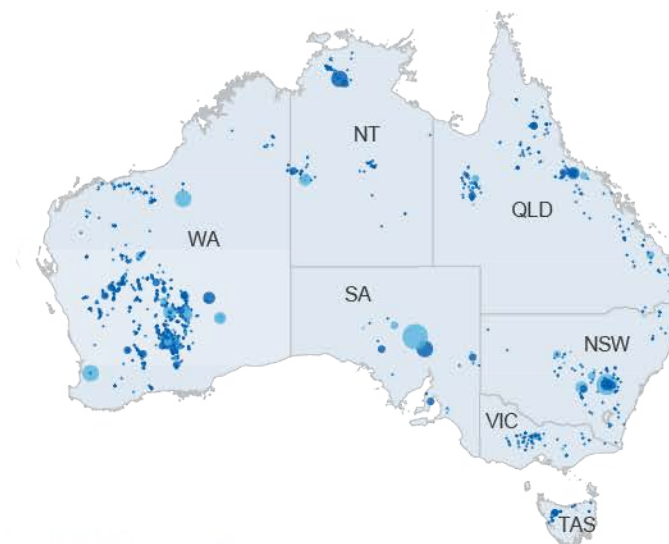
Gold

Resources and Energy Quarterly June 2019

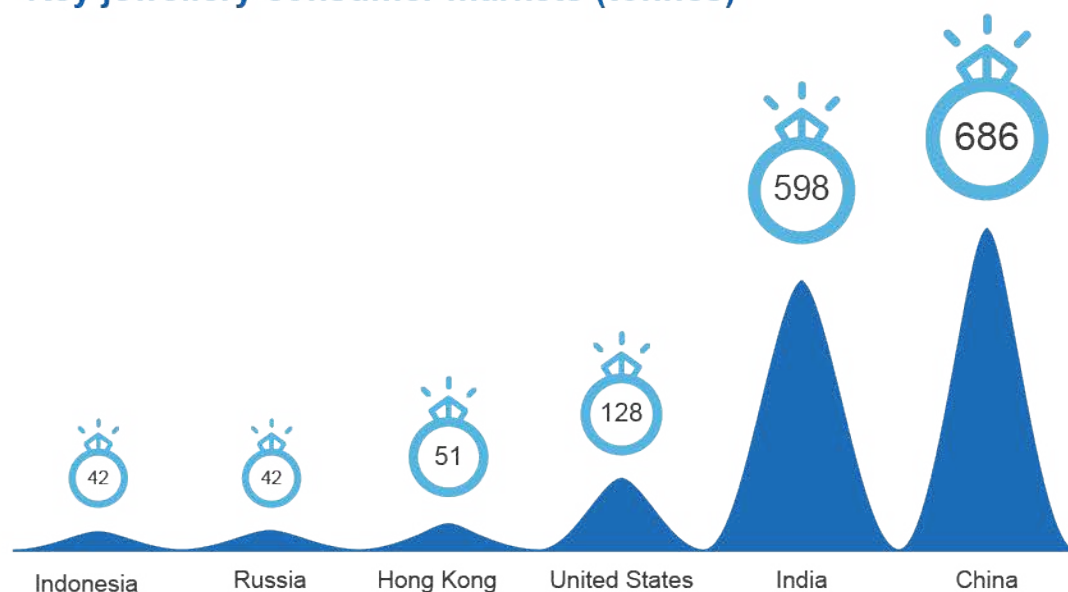


Major Australian gold deposits (tonnes)

- <20
- 21–70
- 71–185
- 186–473
- 474–1,027
- >1,028
- Deposit
- Operating mine



Key jewellery consumer markets (tonnes)



Global uses of gold (tonnes)



10.1 Market summary

- Trade and geopolitical risks are likely to support gold prices, which are forecast to rise to an average US\$1,440 an ounce in 2021.
- Australian export volumes are forecast to increase by 12 per cent in 2020–21, reaching a peak of 370 tonnes of gold.
- Australia's gold exports are forecast to grow through the outlook period, to a peak of over \$22 billion in 2020–21, reflecting expected rises in gold prices, local gold production, and export volumes.
- The Australian gold industry is examined in more detail in one of this edition's special topics.

10.2 Prices

Gold prices rose in the first half of 2019

The gold price increased by 6.1 per cent in the first quarter of 2019, averaging US\$1,304 an ounce (Figure 10.1), due to trade tensions between the US and China. However, hopes of a breakthrough in the US and China trade talks, and easing geopolitical tensions between the US and North Korea put downward pressures on gold prices, dropping below US\$1,300 an ounce between April and early May 2019.

The gold price rose sharply to above US\$1,300 an ounce in mid-May 2019, following the US Administration's decision to lift tariffs from 10 per cent to 25 per cent on US\$200 billion of Chinese imported goods, effective from Friday 10 May 2019. In June 2019, fears of a US slowdown saw markets price out further US interest rate hikes, and some weakness in US equities drove investors to safe havens such as gold.

Gold continues to perform well in the short-term

Gold is expected to perform well over the outlook period, driven by trade and geopolitical uncertainties. Trade tensions between the world's two largest economies — the US and China — are expected to continue and have the potential to derail global economic growth, with flow-on impacts to consumer and business confidence. Geopolitical tensions on the Korean peninsular — linked to sanctions on North Korea and tensions over denuclearisation — and the Middle East — linked to the Gaza

conflict, Syria's civil war, and the US and Iran tensions — are sources of upside risk for the gold price. At times of uncertainty, the demand for safe haven assets such as gold typically rises. The gold price is expected to rise at an average annual rate of 4.2 per cent between 2019 and 2021, averaging US\$1,440 an ounce in 2021.

Figure 10.1: Gold price and US dollar



Source: LBMA (2019) Gold price PM; Refinitiv (2019) USD Trade Weighted Index.

10.3 Consumption

World gold consumption increased in the March quarter 2019

World gold demand increased by 7.0 per cent year-on-year in the March quarter 2019, to 1,053 tonnes, driven by central bank buying and inflows into gold-backed exchange traded funds (ETFs). Over this period, demand from the official sector rose by 68 per cent year-on-year to 145 tonnes — the highest volume of March quarter net purchases since 2013. Economic uncertainties, such as trade tensions and sluggish economic growth, and a desire to diversify out of the US dollar, were the catalyst for central banks' growing appetite towards gold. Gold-backed ETF holdings increased by 48 per cent year-on-year in the first quarter of 2019, with over 40 tonnes (or US\$1.9 billion) of global inflows. The shifting stance of the US Federal

Reserve — which is adopting a more dovish monetary policy approach — supported demand for gold-backed ETFs.

Gold jewellery demand increased by just 0.6 per cent year-on-year in the March quarter 2019, to 530 tonnes, driven by a 5.2 per cent year-on-year rise in demand from India. Indian consumers took advantage of lower gold prices in the first three months of 2019 by rushing to make wedding-related purchases. The rise in India's jewellery demand was offset by a 1.8 per cent year-on-year fall in China's jewellery demand, as trade tensions with the US and a slowing economy affected consumer sentiment.

Gold used in the technology sector dropped by 3.1 per cent year-on-year in the March quarter 2019, to 79 tonnes, due to a weaker electronics sector in the US and the trade tensions between the US and China. During the quarter, Apple — the world's largest tech company — issued its first profit warning in 17 years.

World consumption to rise in 2019 to 2020, before falling in 2021

World gold consumption is forecast to grow at an average annual rate of 3.7 per cent in 2019 and 2020 — reaching a peak of 4,728 tonnes in 2020 — and then decrease by 4.9 per cent in 2021, to 4,497 tonnes (Figure 10.2). The growth is expected to be largely driven by central banks' gold buying, with a forecast increase of 4.3 per cent a year in 2019 and 2020, to over 700 tonnes by 2020. The official sector is expected to remain a net buyer throughout the forecast period. The need to diversify central bank reserves is the key driver of many central banks' growing appetite towards gold. After reaching a peak of 711 tonnes in 2020, the pace of central bank purchases is expected to decrease by 10 per cent in 2021, to 640 tonnes, as geopolitical risks moderate.

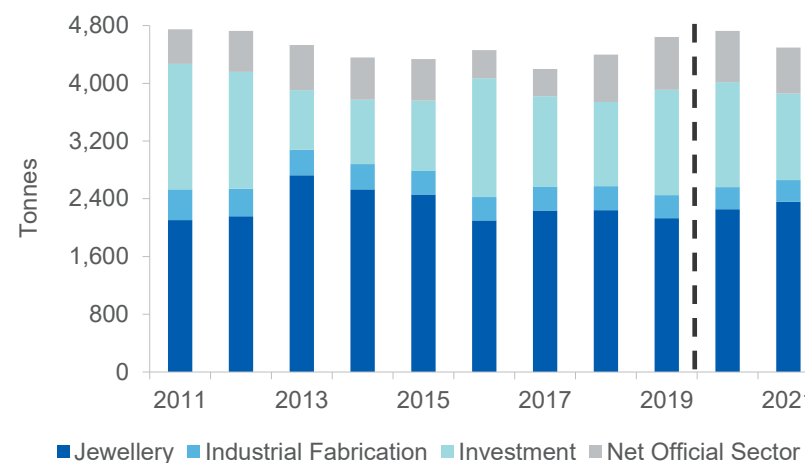
Retail investment is expected to drive up global gold consumption, as the demand for gold bars and coins rises in 2019 and 2020. We expect retail investment to rise by 13 and 12 per cent in 2019 and 2020, to 1,244 and 1,392 tonnes, respectively. This is being supported by trade tensions, the economic slowdown across advanced and developing economies, and political uncertainty in Europe, Venezuela and the Middle East. In China, ongoing trade tensions with the US are likely to boost gold demand, as

retail investors seek to buy gold as a hedge against the depreciation of the Renminbi. However, gold retail investment is expected to slow down after 2020, as global economic slowdown and trade tensions are expected to ease.

Global jewellery consumption is also expected to drive up global gold consumption. Jewellery demand is forecast to rise by 5.7 per cent in 2020 and 4.6 per cent (to 2,357 tonnes) in 2021. Demand from China — the world's largest jewellery consumer — is expected to remain strong, supported by the Chinese Government's monetary and fiscal stimulus. In addition, jewellery production innovation — which has resulted in a widening product offering — is likely to provide consumers with greater choices and support higher demand for gold.

In India — the world's second largest gold jewellery consumer — a strong demand growth forecast is propelled by robust economic growth, ongoing urbanisation, rising farm incomes, and improved consumer sentiment.

Figure 10.2: World gold consumption



Source: World Gold Council (2019) Demand Trends; Department of Industry, Innovation and Science (2019)

10.4 Production

World gold production declined in the March quarter 2019

World gold supply fell by 0.3 per cent year-on-year in the March quarter 2019, to 1,150 tonnes, due to a decline in net hedging, which decreased by 72 per cent year-on-year, to 10 tonnes, as gold producers took advantage of rising gold prices to sell their future gold production.

The Australian dollar gold price hit a record high during the quarter, averaging AUD\$1,811 a troy ounce. As a result, some Australian gold producers opted to secure cash flow for portions of their output. Goldfields — a major Australian gold producer — locked in the price on the entirety of the company's 2019 production.

Lower net producer hedging was offset by a 1.1 per cent year-on-year rise in global gold mine production in the March quarter 2019, to 852 tonnes. The continued ramp-up of production in some gold mines in Australia and Russia drove the production growth.

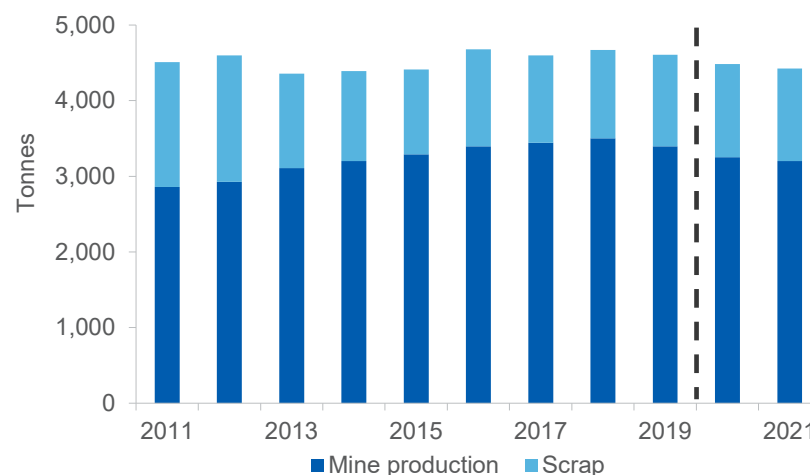
In Australia, the ramp-up of Mount Morgans and increased output at Cadia Valley boosted Australia's gold output by 6.2 per cent year-on-year in the March quarter. Over this period, Russia's gold production increased by 4.0 per cent year-on-year, driven by the ramp-up of the Natalka open pit mine.

Higher gold prices encouraged gold recycling activities, particularly in India, with global gold scrap supply increasing by 4.7 per cent year-on-year in the March quarter 2019, to 288 tonnes.

World gold production expected to fall over the outlook period

World gold supply is forecast to fall at an average annual rate of 1.6 per cent between 2019 and 2021, reaching 4,437 tonnes by the end of the outlook period (Figure 10.3). This reflects long established projects reaching end of life, with few new projects and expansions to take their place. World gold mine production is expected to decline from 3,399 tonnes in 2019 to 3,202 tonnes by 2021. Declining world mine production is expected across most major gold producing countries, and will be

Figure 10.3: World gold production



Source: World Gold Council (2019) Supply Trends; Department of Industry, Innovation and Science (2019)

particularly evident in Australia — which is expected to account for the closure of over 51 tonnes of mine capacity between 2019 and 2021.

China's gold output is expected to fall over the outlook period, as the country's gold miners continue to adapt to stricter environmental regulation. The shift of Indonesia's Grasberg gold mine's operations from open mine to underground is likely to reduce its annual output by 58 tonnes between 2019 and 2021.

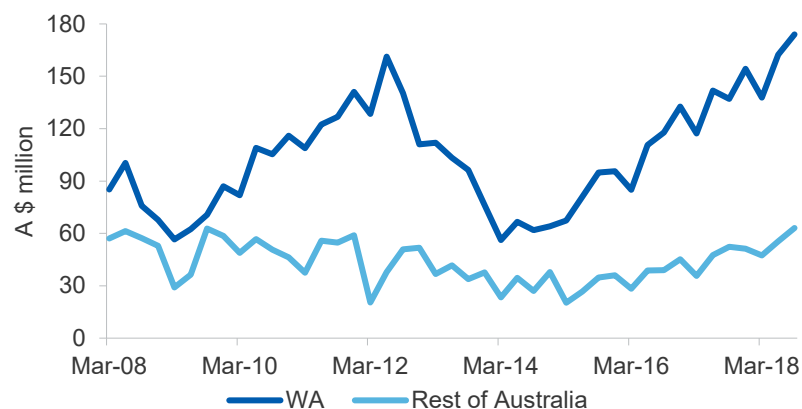
Offsetting the fall in world gold mine production is an expected rise in global gold scrap supply. Recycled gold supply is expected to rise by 2.6 per cent a year in 2019 and 2020, to 1,210 and 1,230 tonnes, respectively, driven by higher gold prices. However, after 2020, recycled supply is forecast to decline slightly, to 1,225 tonnes, due to an expected drop in scrap gold stocks. Scrap supply in the Middle East is also expected to fall as the political climate normalises in Egypt and Turkey.

10.5 Australia

Exploration expenditure continues to increase in trend terms

Australia's gold exploration expenditure rose by 17 per cent year-on-year in the March quarter 2019, to \$220 million, driven by higher Australian gold prices (Figure 10.4). Western Australia remained the centre of gold exploration activity in Australia, accounting for 71 per cent (or \$156 million) of total gold exploration expenditure.

Figure 10.4: Australia's gold exploration



Source: ABS (2018) Mineral and Petroleum Exploration (cat. no. 8412.0)

Australian gold production increased in the March quarter 2019

Australia's gold production rose by 6.2 per cent year-on-year in the March quarter 2019 to reach 77 tonnes. Output was driven by improved output from several large gold mines in New South Wales and Western Australia.

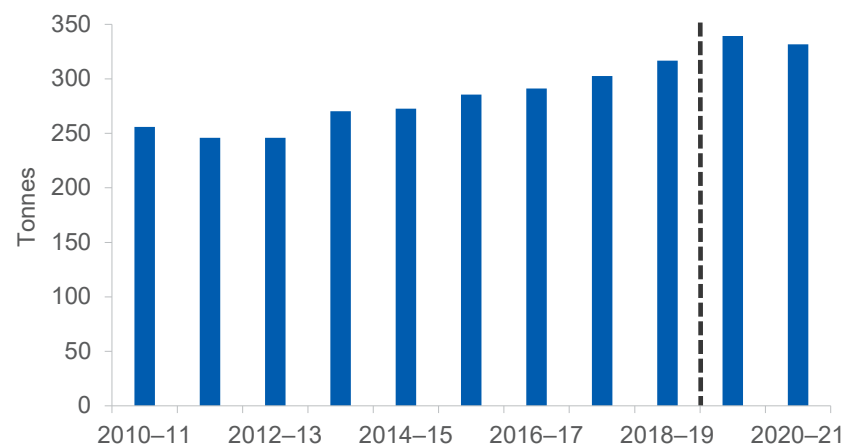
Newcrest's Cadia Valley and Telfer production increased by 53 and 36 per cent year-on-year, to 6.8 and 3.8 tonnes, respectively, driven by increased mill throughput and recovery. Kirkland Lake's Fosterville production rose by 101 per cent year-on-year, to 4.0 tonnes, driven by higher levels of mill throughput and high ore grades. Newmont's Tanami production increased by 13 per cent, to 4.1 tonnes, driven by an improvement in ore grades.

However, production at Newmont's Boddington mine decreased by 4.9 per cent year-on-year in the March quarter 2019, to 4.8 tonnes, due to lower ore grades. Newmont and Barrick's joint-venture Superpit gold mine saw its production decrease by 38 per cent year-on-year in the March quarter 2019, to 3.4 tonnes, and a rock fall incident in mid-May 2018 has led to increased processing of lower grade stockpiles.

Australian gold production forecast to grow in the short term

Australian gold production is estimated to have grown by 4.7 per cent in 2018–19, to 317 tonnes. Production is forecast to peak at 339 tonnes in 2019–20, but then fall to 332 tonnes in 2020–21 (Figure 10.5). The near term growth is expected to be driven by a number of new mines coming online over the forecast period. Gold Roads' Gruyere gold mine (with an annual production of 8.4 tonnes) is expected to commence in the second half of 2019. Capricorn Metals' Karlawinda gold mine project (annual production of 4.0 tonnes) is expected to be commissioned in 2020. Regis Resources' Rosemont mine (annual production of 3.7 tonnes) is expected to commence production in 2020.

Figure 10.5: Australia's gold production



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

Australian gold exports remained unchanged in the March quarter 2019

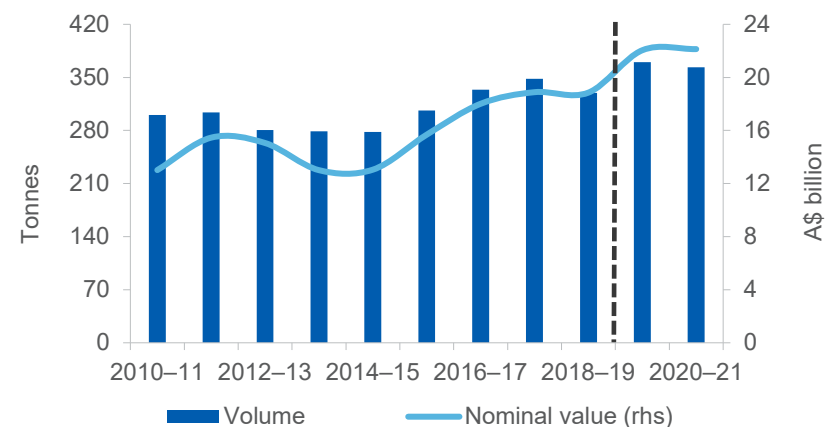
Australia exported 92 tonnes of refined and unrefined gold in the March quarter 2019, valued at \$5.4 billion. Despite a drop in export volumes of 7.0 tonnes year-on-year, export earnings were largely stable, supported by a lower exchange rate. Over this period, gold exports to Hong Kong and China decreased by 30 and 29 per cent year-on-year, to 31 and 15 tonnes, respectively, as China's economic growth slowed. However, gold exports to Singapore rose by 116 per cent year-on-year, to 9.5 tonnes, as the south-east Asian precious metals hub increased physical gold trading activities with its neighbours.

Exports forecast to continue to grow until 2020–21

Australia's gold exports are forecast to grow through the outlook period, to a peak of over \$22 billion in 2020–21 (Figure 10.6). This growth reflects expected rises in Australian gold prices, gold production and export volumes.

The risk to this assessment is an upward movement in gold prices, due to increased demand for safe haven assets, given trade tensions between the US and its trading partners, geopolitical tensions in the Korean peninsula and the Middle East, and political uncertainty in Europe.

Figure 10.6: Australia's gold exports



Source: ABS (2019) International Trade, 5464.0; Department of Industry, Innovation and Science (2019)

Table 10.1: Gold outlook

World	Unit	2018	2019 ^s	2020 ^f	2021 ^f	Annual percentage change		
						2019 ^s	2020 ^f	2021 ^f
Total demand	t	4,399	4,641	4,728	4,497	5.5	1.9	-4.9
Fabrication consumption ^b	t	2,577	2,451	2,562	2,661	-4.9	4.5	3.8
Mine production	t	3,503	3,399	3,254	3,202	-3.0	-4.3	-1.6
Price ^c								
Nominal	US\$/oz	1,269	1,326	1,388	1,437	4.5	4.7	3.5
Real ^d	US\$/oz	1,298	1,326	1,357	1,375	2.2	2.3	1.3
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2018–19 ^s	2019–20 ^f	2020–21 ^f
Mine production	T	303	317	339	332	4.7	7.2	-2.2
Export volume	T	348	329	370	363	-5.4	12.4	-1.9
Nominal value	A\$m	18,888	18,853	22,048	22,133	-0.2	16.9	0.4
Real value ^e	A\$m	19,264	18,853	21,532	21,095	-2.1	14.2	-2.0
Price								
Nominal	A\$/oz	1,674	1,754	1,852	1,896	4.7	5.6	2.4
Real ^e	A\$/oz	1,708	1,754	1,809	1,807	2.7	3.1	-0.1

Notes: **b** includes jewellery consumption and industrial applications; **c** London Bullion Market Association PM price; **d** In 2019 calendar year US dollars; **e** In 2018–19 financial year Australian dollars; **f** Forecast; **s** Estimate.

Source: ABS (2019) International Trade, 5465.0; London Bullion Market Association (2019) gold price PM; World Gold Council (2019); Department of Industry, Innovation and Science (2019)

Aluminium

Resources and Energy Quarterly June 2019

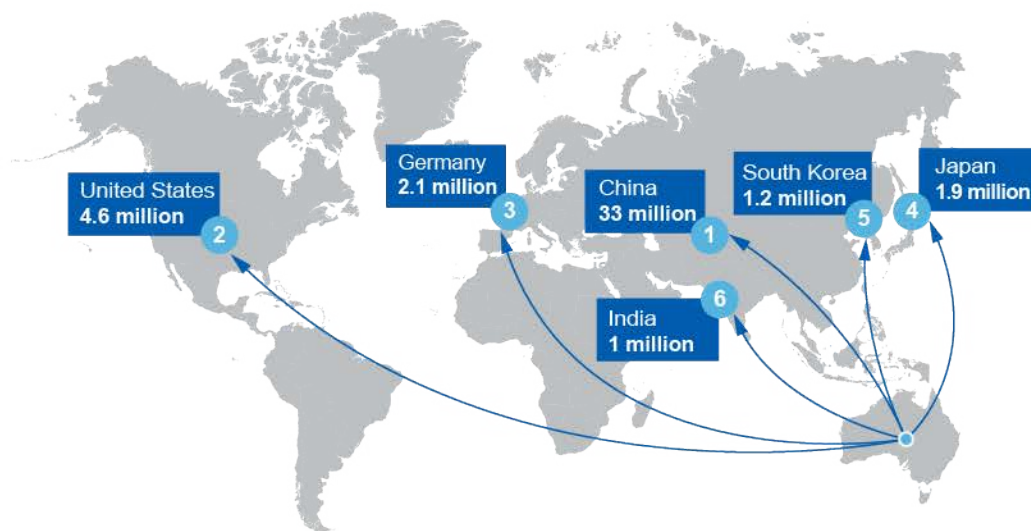
Australia's global ranking



3 stages of producing aluminium



Key consumer markets for aluminium (tonnes)

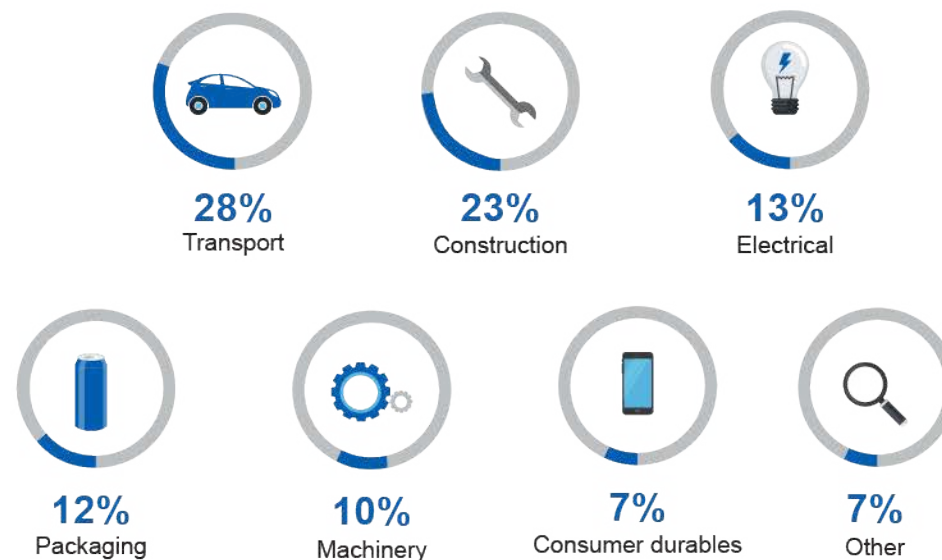


Major Australian alumina deposits (Gt)

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



Global uses of aluminium



11.1 Summary

- Aluminium prices are forecast to average US\$1,880 a tonne in 2019, before rising to average US\$2,015 a tonne by 2021, driven by China's monetary and fiscal stimulus. However, alumina prices are forecast to fall over the outlook period, averaging US\$363 a tonne in 2021, due to growing supply.
- With no planned expansions to smelter or refinery capacity in Australia until 2020–21, annual output is forecast to remain at 1.6 million tonnes for aluminium and 20 million tonnes for alumina over the outlook period.
- Total Australian export value of aluminium, alumina and bauxite are expected to peak at \$16 billion in 2018–19, before declining to \$14 billion in 2020–21.

11.2 Prices

Aluminium and alumina prices fell sharply in the June quarter 2019

The London Metal Exchange (LME) spot price for aluminium fell by 20 per cent year-on-year in the June quarter 2019, averaging an estimated US\$1,799 a tonne, as escalating trade tensions between the US and China continued to dampen aluminium demand from China — the world's largest aluminium consumer. Another contributing factor was the lifting of US trade and financial sanctions on the largest Russian aluminium producer, Rusal.

The Chinese Government's fiscal stimulus measures aimed at offsetting the impacts of trade tensions with the US are expected to boost aluminium demand and bolster global aluminium prices in the second half of 2019. Despite this, the LME spot price is forecast to fall by 11 per cent in 2019, and average US\$1,879 a tonne (Figure 11.1).

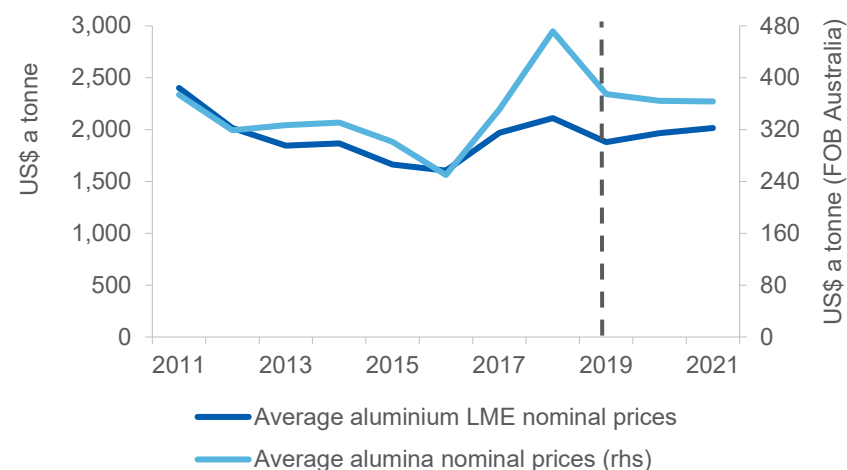
The free on board (FOB) Australian alumina price was also lower in the June quarter 2019, dropping by an estimated 28 per cent year-on-year, and averaging US\$372 a tonne. The price fall can largely be attributed to higher supply, helped by the start of production at the 2.0 million tonnes per year Al Taweelah refinery in the United Arab Emirates in April 2019.

Another contributing factor to the price fall was the anticipated resolution of Rusal sanctions. These same factors are expected to continue to weigh on the FOB Australian alumina price through the rest of 2019. The price is forecast to average US\$375 a tonne, a fall of 20 per cent from the 2018 average (Figure 11.1).

Aluminium prices to rise, but alumina prices to fall in 2020 and 2021

The LME aluminium spot price is forecast to increase by 4.7 per cent to average US\$1,967 a tonne in 2020, and by a further 2.5 per cent in 2021 to average US\$2,015 a tonne (Figure 11.1). Environmental regulations and winter production curtailment policies in China are expected to continue, which is likely to provide some price support. Further factors likely to drive prices higher, the Chinese Government's fiscal stimulus measures are expected to boost demand for aluminium. The Chinese measures have also boosted the aluminium demand outlook for many other emerging market economies such as Vietnam and Thailand, due to China's growing import requirements.

Figure 11.1: World aluminium and alumina prices



Source: LME (2019) spot prices; Metals Bulletin (2019) Alumina monthly price; Department of Industry, Innovation and Science (2019).

Despite a forecast price rise over the outlook period, it is expected to be lower than in 2018, when US-imposed sanctions on Rusal resulted in a substantial price spike.

The FOB Australian alumina price is expected to fall by 2.8 per cent to average US\$364 a tonne in 2020, and by a further 0.3 per cent to average US\$363 a tonne in 2021 (Figure 11.1), driven by growing global supply. Norsk Hydro's 6.2 million tonnes per year Alunorte alumina refinery in Brazil — the world's largest — has been operating at half capacity after a spill in February 2018 that prompted the regulators and courts to restrict output. All restrictions were lifted in May 2019, and Alunorte is expected to return to full production in the second half of 2019.

11.3 Consumption

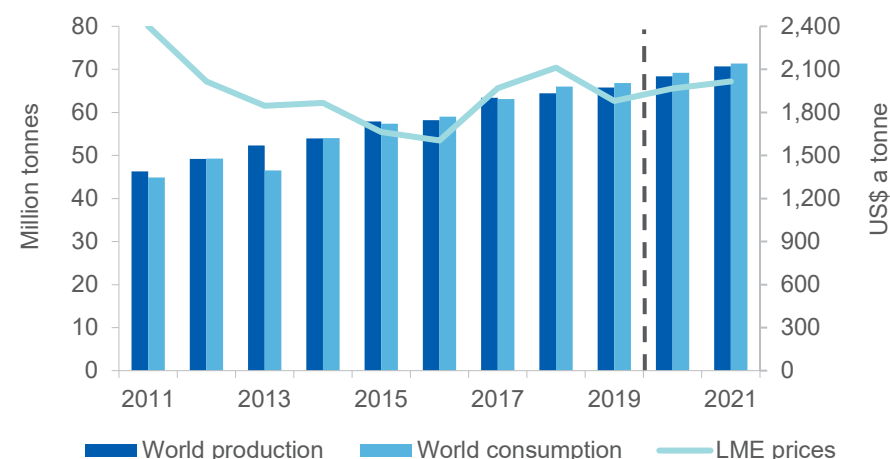
Modest rise in global aluminium and alumina consumption in June quarter

Global aluminium consumption is estimated to have increased by just 1.3 per cent year-on-year in the June quarter 2019, to over 16 million tonnes. Both escalating trade tensions between the US and China, and slowing global economic growth, softened the demand for aluminium. As the world's largest aluminium consumer, China is estimated to have consumed 9.4 million tonnes of aluminium in the June quarter, an increase of 0.5 per cent year-on-year. Sales in the Chinese automotive sector (one of the country's largest aluminium consumers) fell by 14 per cent year-on-year in April 2019, to 1.9 million units, marking the tenth consecutive month of decline.

Trade tensions between the US and China are unlikely to be resolved this year, and are expected to flow on to lower business and investment confidence and to a slowdown in global economic growth. Global industrial production — a leading indicator for aluminium demand — is forecast to increase at a slower pace, averaging 2.1 per cent per quarter over the remainder of 2019. As a result, global aluminium consumption is forecast to only grow modestly (by 1.2 per cent) in 2019, to reach nearly 67 million tonnes (Figure 11.2).

World alumina consumption is estimated to have increased by 1.3 per cent year-on-year in the June quarter 2019 to over 30 million tonnes. The

Figure 11.2: World aluminium production, consumption and prices



Source: International Aluminium Institute (2019); AME (2019); World Bureau of Metal Statistics (2019); Department of Industry, Innovation and Science (2019)

rise came as Chinese aluminium smelters ramped up production after the winter production curtailment. Over this period, China's alumina consumption is estimated to have increased by 3.4 per cent year-on-year, to over 17 million tonnes. However, global demand for alumina is expected to be depressed for the remainder of 2019, due to ongoing trade tensions between the US and China, deteriorating global economic growth, and policies to reduce air pollution in China. As a result, global alumina consumption is forecast to rise only marginally, by 0.5 per cent, in 2019, to reach just over 120 million tonnes (Figure 11.3).

Aluminium demand to continue to grow

World primary aluminium demand is forecast to grow at an average annual rate of 3.4 per cent in 2020 and 2021, to reach 71 million tonnes by 2021 (Figure 11.2). The gains will be driven by rising demand from the global automotive industry.

A significant driver of aluminium demand is expected to come from automobiles, particularly energy efficient vehicles containing an increasing proportion of aluminium components. Automakers across the world are working to replace internal combustion engines with electrical engines,

and are seeking to reduce vehicles' weight by increasing the use of aluminium, which is 10 to 40 per cent lighter than steel.

Despite slowing economic growth, the Chinese government's infrastructure projects and ambitious initiatives for promoting electric vehicle production are expected to bolster demand for aluminium. These initiatives are likely to offset the impacts of trade tensions with the US. China's aluminium consumption is expected to continue to grow strongly over the next two years, reaching 39 million tonnes in 2020.

Outside of China, the North American market is expected to drive aluminium demand over the forecast period and beyond. The US Administration's recent decision to lift tariffs on steel and aluminium imports from Canada and Mexico has opened the way for the ratification of the US, Mexico and Canada (USMCA) trade agreement — replacing the North America Free Trade Agreement (NAFTA).

The USMCA is expected to benefit the US automotive and aluminium industries by bringing in extra business (estimated around US\$600 million over five years). As new rules of origin come into force that require 75 per cent of auto contents to be produced on the North American continent, it is likely that aluminium consumption will be boosted. Braid Industries — a joint-venture aluminium smelter between Rusal and Braidy — has secured a supply agreement that will see it supply BMW German car manufacturer with high quality automotive aluminium alloy sheet metal when the company's plant commences production in 2021.

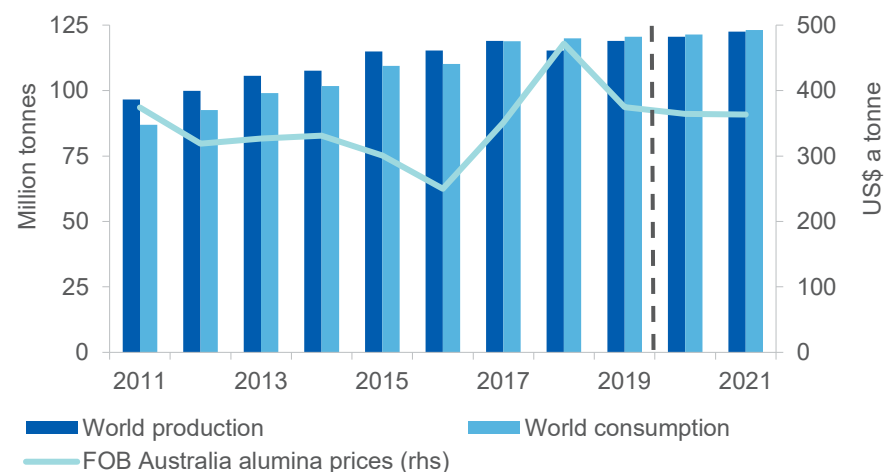
World alumina consumption is forecast to increase at an average annual rate of 1.1 per cent in 2020 and 2021, to reach 123 million tonnes by 2021 (Figure 11.3). Despite slowing economic growth, China is expected to remain the world's largest (and growing) source of alumina demand, accounting for 57 per cent (or 72 million tonnes) of world alumina consumption. The US is expected to see a gradual increase in demand over the outlook period, and Russia, India and the United Arab Emirates (UAE) are expected to remain the additional sources of alumina demand. However, the UAE's demand is likely to be reduced following its recently opened Al Taweelah alumina refinery with further expanded capacity.

11.4 Production

World production of aluminium and alumina rose in 2019

World aluminium production is estimated to have increased by 3.2 per cent year-on-year in the June quarter 2019, to nearly 17 million tonnes. China — the world's largest aluminium producer — is estimated to have produced 9.5 million tonnes of primary aluminium over this period, up by 3.5 per cent year-on-year.

Figure 11.3: World alumina production, consumption and prices



Source: International Aluminium Institute (2019); AME (2019); World Bureau of Metal Statistics (2019); Department of Industry, Innovation and Science (2019)

Following the Chinese Lunar New Year period and the end of the winter production curtailment period, Chinese aluminium smelters have ramped up production to take advantage of production curtailments in Europe and South America that have kept production capacity low. In Brazil, Albras Aluminium, partly owned by Norsk Hydro, has curtailed 50 per cent of its 460,000 tonne annual capacity since mid-April 2018, after its raw material supplier, Alunorte, was forced to operate at half capacity since March 2018 due to restrictions imposed by Brazilian environmental authorities amid concerns of water contamination.

Global aluminium supply is forecast to increase by 2.1 per cent in 2019, to reach nearly 66 million tonnes (Figure 11.2). The rise will be driven by increases in Chinese aluminium capacity, originating from the ramp-up of new aluminium smelters. These include the 500,000 tonnes per year East Hope Guyang, Chuangyuan and Qianhengda smelters, and the 400,000 tonnes per year Baiyinhua aluminium smelter. Outside of China, the 300,000 tonnes per annum SALCO aluminium smelter in Iran, and the 450,000 tonnes per year Tran Hong Quan aluminium smelter in Vietnam are expected to start production in the second half of 2019. Albras Aluminium is expected to resume normal operations and reach full production capacity in the second half of 2019, following the removal of production restrictions at the Alunorte alumina refinery.

World alumina supply is estimated to rise by 3.1 per cent in 2019, to reach 119 million tonnes (Figure 11.3), driven by additions of new refineries and expansion at existing alumina refineries. The 2.0 million tonnes per year Al Taweelah alumina refinery in the UAE started production in April 2019, and is expected to reach at least 70 per cent of its capacity by the end of 2019. The Alunorte alumina refinery in Brazil is expected to resume full production in the second half of 2019, and it will bring 3.0 million tonnes per year of alumina production capacity back online.

World production of aluminium and alumina to continue to rise

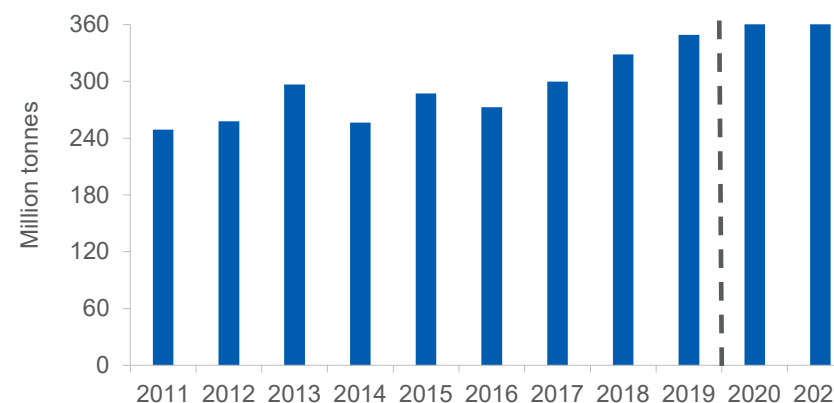
World aluminium production is forecast to rise by 3.9 per cent in 2020 and by a further 3.5 per cent in 2021, to reach 71 million tonnes in 2021 (Figure 11.2). The gains will be driven by new additional capacity from China, Bahrain and Iran. It is estimated that over 4.4 million tonnes of new and expanded smelting capacity will come online in 2020, of which 30 per cent is from China. Iran is implementing its plan to increase its annual aluminium production to 1.5 million tonnes by 2025, with the 300,000 tonnes per year SALCO aluminium smelter due to commence production later this year. In Bahrain, the 540,000 per annum Alba expansion project is expected to be completed in late 2019. Additional capacity is also expected from the US, with producers such as Century Aluminium to restart their idled operations. The risk to this assessment is rising energy

prices in Australia and North America, which will continue to place pressure on aluminium producers.

World alumina production is also forecast to increase by 1.4 per cent in 2020 to 120 million tonnes, and by a further 1.6 per cent in 2021, to reach 122 million tonnes (Figure 11.3). The growth of alumina supply is expected to originate from the Southeast Asian region and Africa, where bauxite resources are in abundant supply. Vietnam is an emerging alumina supplier, with the Tan Rai and Nhan Co alumina refineries benefiting from low bauxite feed costs — due to their close proximity to large reserves of good quality bauxite.

Guinea has rapidly developed as a key bauxite producer, and aims to develop its alumina refinery industry with a number of potential refinery projects announced over the last few years. In November 2018, a consortium between Societe Miniere de Boke (owned by the Guinean Government) and Singapore's Winning Shipping signed an agreement to build the first alumina refinery in Guinea.

Figure 11.4: World bauxite production



Source: World Bureau of Metal Statistics (2019); Department of Industry, Innovation and Science (2019)

World bauxite production is forecast to grow at an annual average rate of 2.0 per cent in 2020 and 2021, to reach 380 million tonnes by 2021 (Figure 11.4). The gains are expected to be driven by newly added capacity in Australia — the world's largest bauxite producer — and Guinea. With its degrading domestic bauxite quality, Chinese aluminium smelters and alumina refineries are increasingly looking to source bauxite externally, particularly from Guinea. With a growing investment pipeline, Guinea is likely to overtake China as the world's second largest bauxite producer at the end of the outlook period.

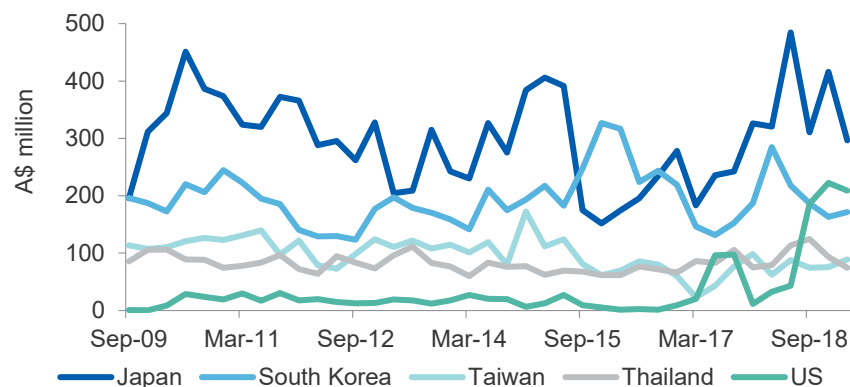
11.5 Australia's exports and production

High prices to drive strong exports earnings in 2018–19

In 2018–19, Australia's aluminium, alumina and bauxite exports are estimated to have grown strongly from 2017–18, increasing by 14 per cent to reach almost \$16 billion — a record high. Higher aluminium and alumina prices are the main contributing factors to the record high.

Australia's primary aluminium exports to the US increased by 335 per cent year-on-year in the first three quarters of 2018–19, to \$618 million (Figure 11.5), propelled by the tariff-exempt status that the US Administration granted to Australia.

Figure 11.5: Australia's major aluminium export markets by value

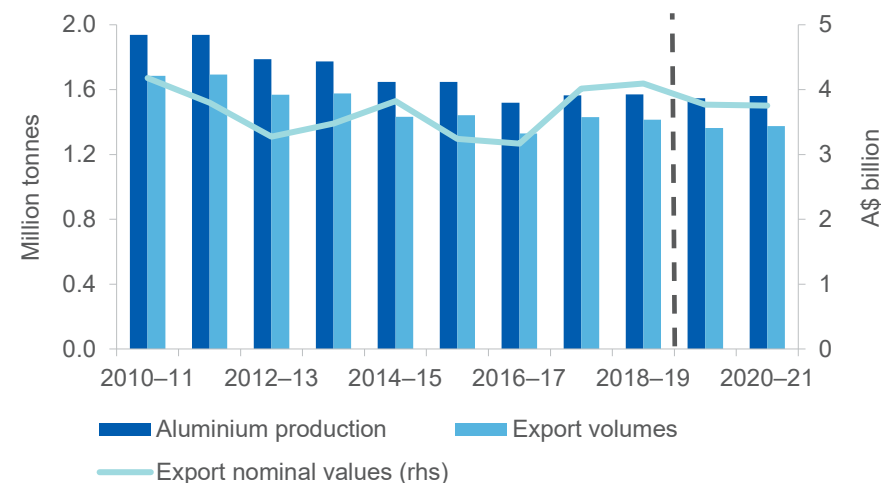


Source: ABS (2018) International Trade in Goods and Services, 5368.0

Lower alumina prices lead to weaker export outlook to 2020–21

After reaching a record high of \$16 billion in 2018–19, Australia's aluminium, alumina and bauxite exports are forecast to fall by 14 per cent in 2019–20 and by a further 0.2 per cent in 2020–21 to under \$14 billion in 2020–21 (Figure 11.6). The decline is due to the impact of an expected softening of prices for alumina over the outlook period, which will only be partially offset by the impact of increased export volumes of bauxite.

Figure 11.6: Australia's aluminium exports and production



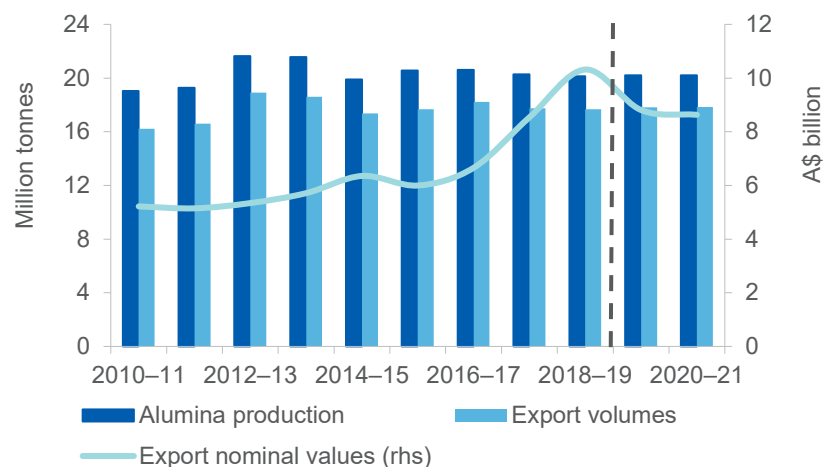
Source: ABS (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019)

The bauxite supply tightness in China's inland region — such as Henan and Shanxi provinces — has been a direct result of China's limited bauxite resources being depleted through many years of exploration and mining, and by the government's stringent environmental requirements.

Environmental priorities are likely to remain an important influence on the Chinese aluminium, alumina and bauxite industries, with flow-on effects for Australian alumina and bauxite exporters. The Chinese government is committed to curbing air pollution in major Chinese cities, and is expected to close smelters and refineries that fail to meet new standards. While this

is expected to tighten global aluminium and alumina supply, it could also reduce demand for Australian alumina and bauxite in the short term.

Figure 11.7: Australia's alumina exports and production



Source: ABS (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019)

The US Administration lifted tariffs on steel and aluminium imports from Canada and Mexico on 18 May 2019. They accounted for over 39 per cent (or US\$9.4 billion) of US aluminium imports in 2018. The decision is likely to impact Australia's share of US aluminium imports by 1.5 per cent.

Steady aluminium production, slight fall in alumina production, but moderate growth in bauxite production in 2018–19

Australia is estimated to have produced 1.6 million tonnes of primary aluminium in 2018–19, up by 0.4 per cent on 2017–18. The increase is attributed to a 1.7 per cent rise in Portland Aluminium's production, with aluminium production from other aluminium smelters estimated to have remained broadly unchanged. However, Australia's alumina production is estimated to have fallen by 0.8 per cent in 2018–19, to around 20 million tonnes, impacted by several cyclones in Queensland.

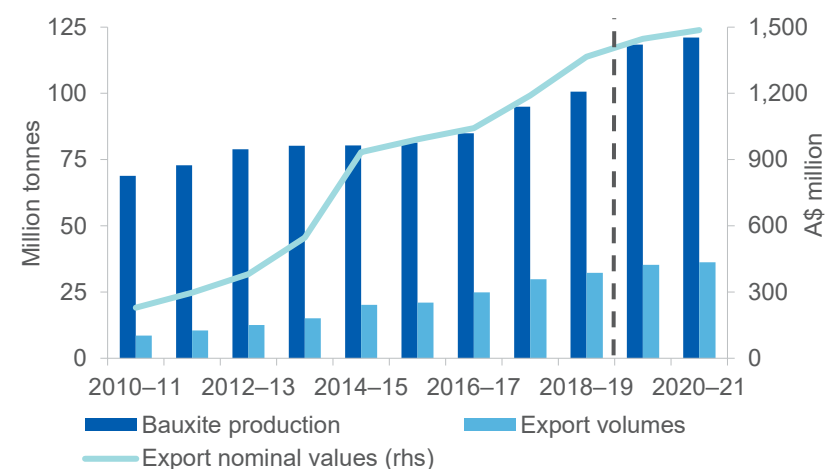
Australia's bauxite production is estimated to have increased by 6.0 per cent in 2018–19, to nearly 101 million tonnes, driven by the addition of new capacity at Rio Tinto's Amrun bauxite project and Metro Mining's Bauxite Hills project in Queensland. The Bauxite Hills mine returned to production in mid-April, after a planned hiatus during the wet season in far north Queensland. The owner of the Bauxite Hills has targeted a 75 per cent gain in output in 2019, from 2.0 million tonnes to 3.5 million tonnes.

Amrun's return to full capacity to drive strong growth in bauxite output

With no planned expansions to smelter or refinery capacity in the short-term, annual output is forecast to remain at 1.6 million tonnes of aluminium and 20 million tonnes of alumina through to 2020–21.

Australia's bauxite production is forecast to grow by 18 and 2.2 per cent in 2019–20 and 2020–21, to 118 and 121 million tonnes, respectively (Figure 11.8). The Amrun bauxite project is expected to reach full production capacity of 23 million tonnes per year in late 2019.

Figure 11.8: Australia's bauxite exports and production



Source: ABS (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019)

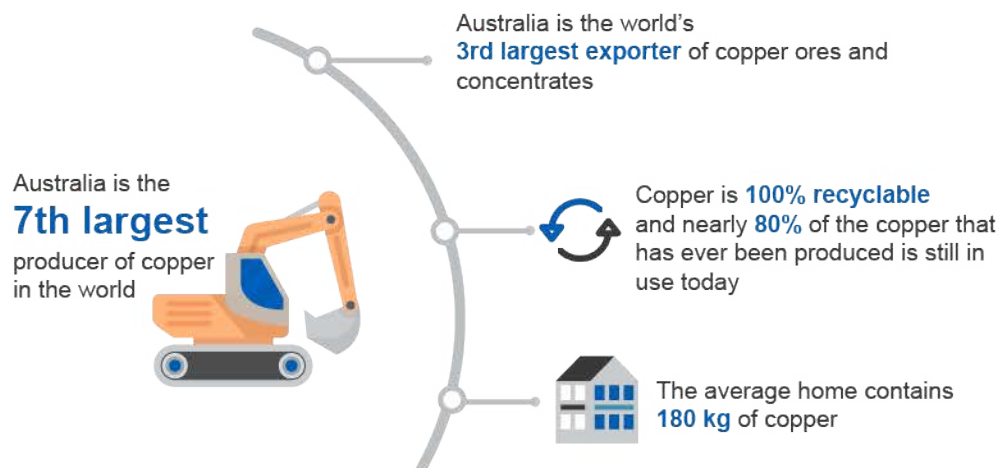
Table 11.1: Aluminium, alumina and bauxite outlook

						Annual percentage change		
World	Unit	2018	2019 ^f	2020 ^f	2021 ^f	2019 ^f	2020 ^f	2021 ^f
Primary aluminium								
Production	kt	64,408	65,791	68,349	70,713	2.1	3.9	3.5
Consumption	kt	65,985	66,787	69,179	71,375	1.2	3.6	3.2
Closing stocks ^b	kt	2,284	2,115	1,962	1,635	-7.4	-7.2	-16.7
- weeks of consumption		13.8	16.2	18.3	19.7	17.9	12.6	7.5
Prices aluminium ^c								
- nominal	US\$/t	2,111	1,879	1,967	2,015	-11.0	4.7	2.5
- real ^d	US\$/t	2,159	1,879	1,923	1,928	-13.0	2.3	0.3
Prices alumina spot								
- nominal	US\$/t	471.6	374.8	364.4	363.4	-20.5	-2.8	-0.3
- real ^d	US\$/t	482.3	374.8	356.2	347.7	-22.3	-5.0	-2.4
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^{fs}	2020–21 ^f	2018–19 ^f	2019–20 ^f	2020–21 ^f
Production								
Primary aluminium	kt	1,564	1,571	1,547	1,561	0.4	-1.5	0.9
Alumina	kt	20,280	20,127	20,206	20,204	-0.8	0.4	0.0
Bauxite	Mt	95.0	101.3	118.4	121.0	6.6	17.0	2.2
Consumption								
Primary aluminium	kt	172	156	185	234	-9.6	18.6	26.7
Exports								
Primary aluminium	kt	1,431	1,410	1,362	1,373	-1.4	-3.4	0.9
- nominal value	A\$m	4,013	3,958	3,445	3,510	-1.4	-13.0	1.9
- real value ^e	A\$m	4,093	3,958	3,364	3,345	-3.3	-15.0	-0.6
Alumina	kt	17,746	17,684	17,803	17,839	-0.4	0.7	0.2
- nominal value	A\$m	8,537	10,285	8,600	8,472	20.5	-16.4	-1.5
- real value ^e	A\$m	8,707	10,285	8,398	8,074	18.1	-18.3	-3.9
Bauxite	kt	29,880	32,248	35,533	36,307	7.9	10.2	2.2
- nominal value	A\$m	1,190	1,359	1,457	1,489	14.2	7.2	2.2
- real value ^e	A\$m	1,214	1,359	1,423	1,419	12.0	4.7	-0.3
Total value								
- nominal value	A\$m	13,740	15,602	13,502	13,470	13.6	-13.5	-0.2
- real value ^e	A\$m	14,014	15,602	13,185	12,839	11.3	-15.5	-2.6

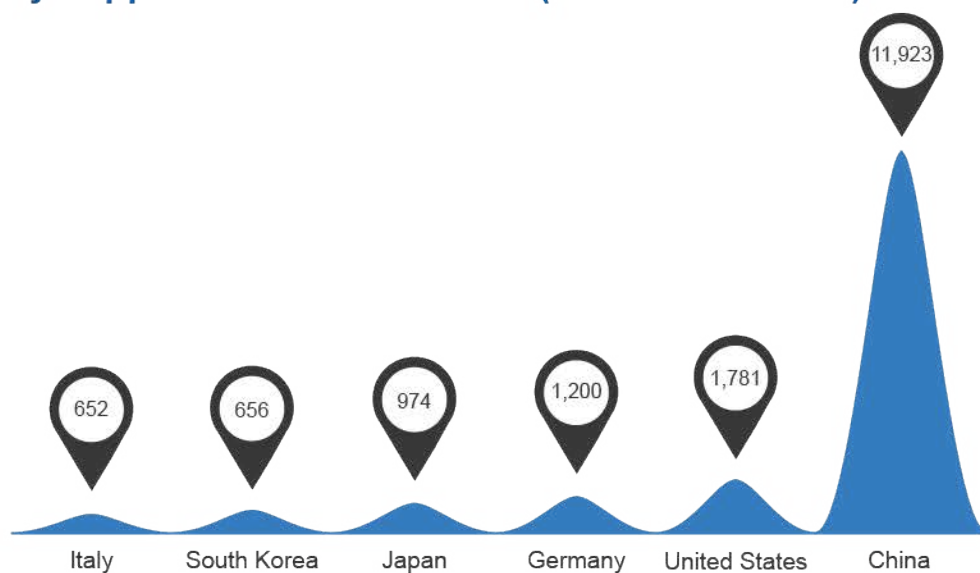
Notes: ^b Producer and LME stocks; ^c LME cash prices for primary aluminium; ^d In 2019 calendar year US dollars; ^e In 2018-19 financial year Australian dollars; ^s Estimate; ^f Forecast; Source: ABS (2019) International Trade in Goods and Services, 5368.0; AME Group (2018); LME (2019); Department of Industry, Innovation and Science (2019); International Aluminium Institute (2019); World Bureau of Metal Statistics (2019)

Copper

Resources and Energy Quarterly June 2019

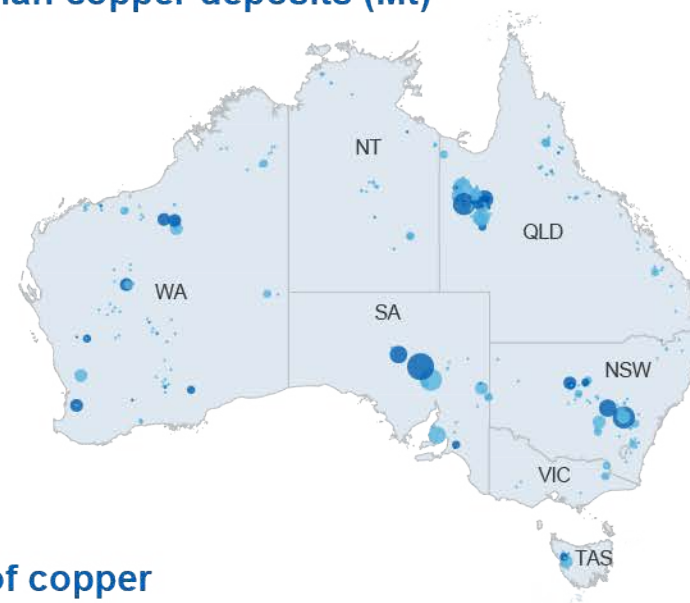


Key copper consumer markets (thousand tonnes)

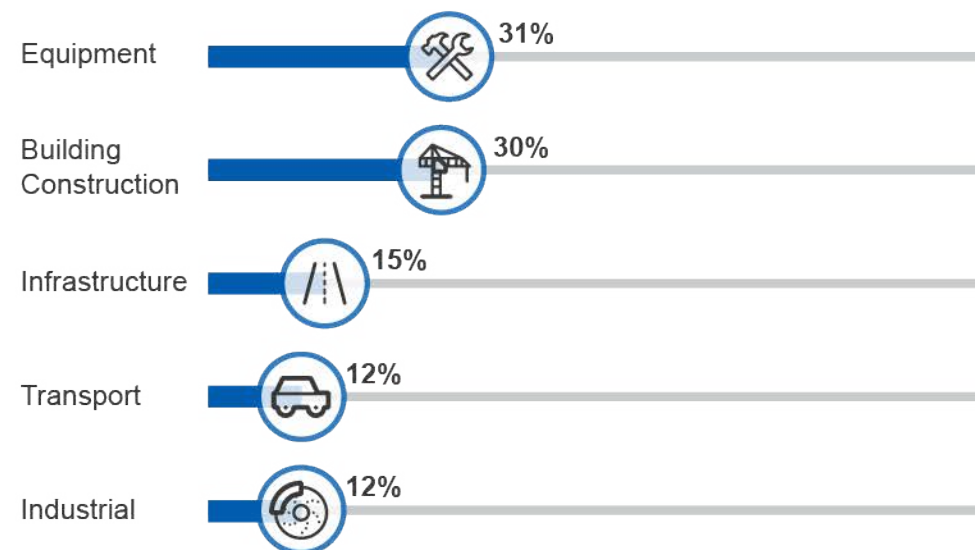


Major Australian copper deposits (Mt)

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



Global uses of copper



12.1 Summary

- Copper prices have fallen in recent months, as a result of lower consumption in China and expectations about the health of the world economy. This price trend is expected to turnaround over the outlook period, as expanding consumer markets lead to a market deficit and higher prices. The copper price is forecast to average over US\$6,480 a tonne in 2019, before increasing to US\$7,750 a tonne in 2021.
- Higher domestic copper output is expected to drive rising Australian export volumes, from an estimated 941,000 tonnes in 2018–19 to around 1.0 million tonnes (in metal content terms) in 2020–21.
- Australia's copper export earnings are forecast to grow from an estimated \$9.5 billion in 2018–19 to \$12 billion in 2020–21, supported by both higher prices and export volumes.

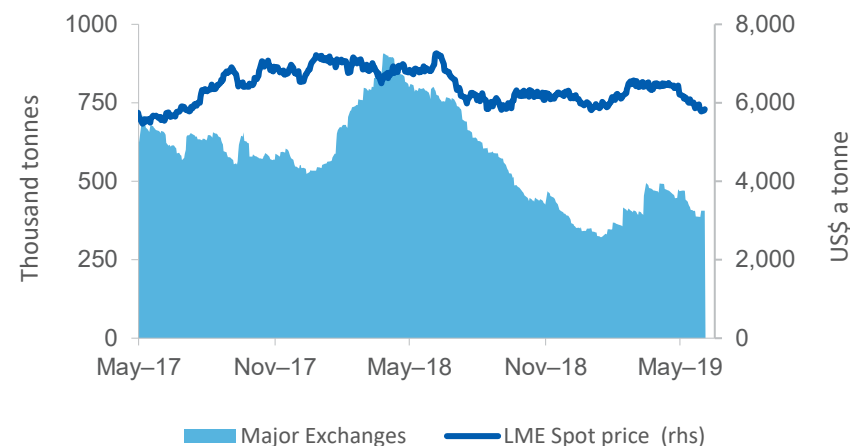
12.2 Prices

Copper prices knocked around by trade tensions despite market deficit

Copper prices have remained relatively solid in 2019, though with some recent weakness evident. Prices for the first six months of the year averaged \$6,179 a tonne, 10 per cent lower than the same period in 2018. The influence of the US-China trade tensions and expectations about negative impacts on copper consumption, resulted in some price volatility in the June quarter. The price hit a low of \$5,781 a tonne around the end of May (Figure 12.1).

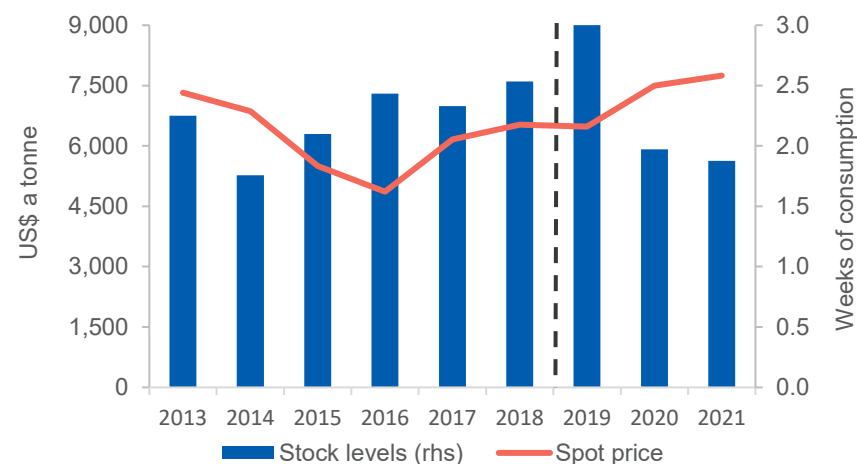
Consumption growth is expected to outpace production over the outlook period, leading to a steady increase in prices. Prices are forecast to grow at an average annual rate of 6.1 per cent over the outlook period, to average US\$7,750 a tonne in 2021 (Figure 12.2). Copper is heavily used in a number of expanding markets — transportation, energy infrastructure and energy storage. This means copper is intrinsically connected to the global economy, and any downturn in economic growth due to the escalation of the US-China trade tensions could thus pose a significant risk to the price outlook.

Figure 12.1: Recent copper spot price and stock movements



Source: LME (2019) official cash price; Bloomberg (2019) stock inventory at LME, COMEX and SHFE.

Figure 12.2: Outlook for copper prices and stocks



Source: LME (2019) official cash price; Department of Industry, Innovation and Science (2019)

12.3 World consumption

Expanding markets promote healthy consumption growth

Expanding markets in Asia, particularly in China, are expected to be the dominant driver of copper consumption growth, offsetting the impact of weaker economic activity and industrial production elsewhere. World copper consumption is forecast to increase at an average annual rate of 2.4 per cent over the outlook period, to reach 26 million tonnes in 2021 (Figure 12.3).

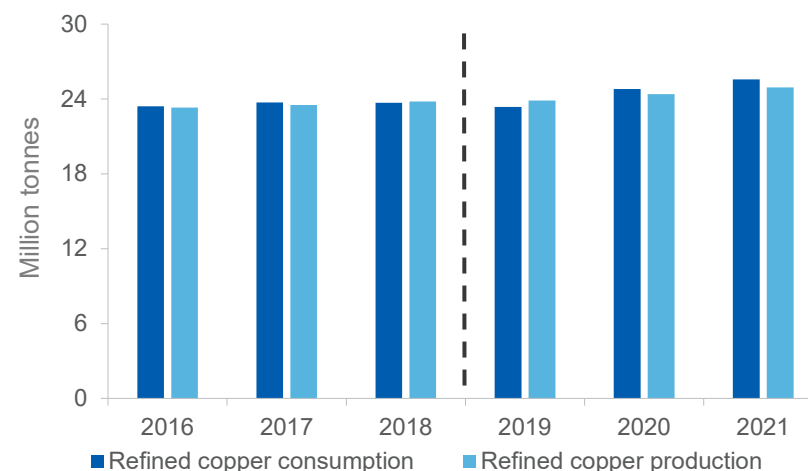
China accounts for around half of world refined copper consumption and is expected show the most significant growth over the outlook, as it upgrades its electricity generation and distribution infrastructure. Consumption is forecast to grow at an average 2.3 per cent a year to 2021, in part supported by targeted government stimulus.

Copper consumption in the US, Germany and India is also expected to show healthy expansion over the outlook period — the US and India are both forecast to increase consumption by 85 thousand tonnes between 2018 and 2021.

Technological advances are expected to stimulate refined copper consumption going forward, particularly with growing electric vehicle (EV) manufacturing. On average, EV's use more than four times as much copper as internal combustion engine vehicles and EVs account for a small but growing share of vehicle sales. China is the largest consumer market and EV sales averaged 6.2 per cent of all vehicles sales in the last two quarters. In China, EV sales have been supported by local and national government policies, however direct subsidies are now being phased out.

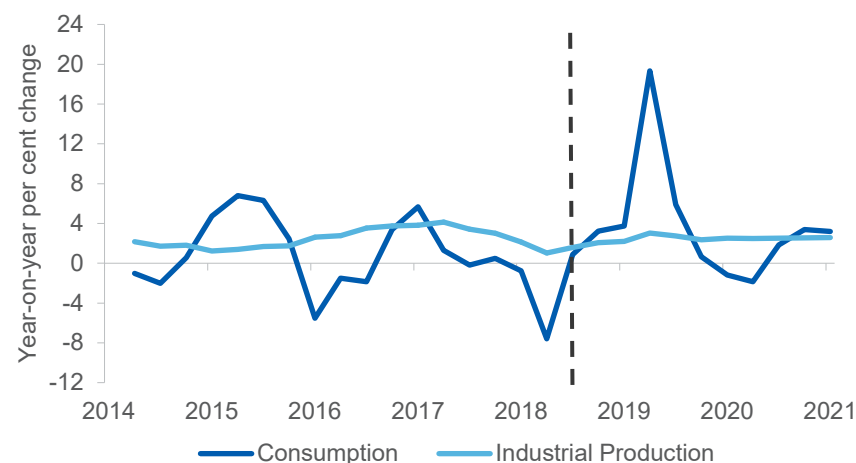
The consumption growth forecast comes with significant risks. Copper is fundamentally tied to industrial production and economic growth, so a decrease in world trade and industrial production over the coming years is likely to impact on usage (Figure 12.4). Increasing environmental restrictions around smelter activity may limit future activity, as shown by the ongoing closure of Vendanta Resources' Tuticorin smelter in India.

Figure 12.3: World balance of refined copper



Source: World Bureau of Metal Statistics (2019); Department of Industry, Innovation and Science (2019)

Figure 12.4: World copper consumption and industrial production



Source: World Bureau of Metal Statistics (2019); Bloomberg (2019) Netherland CPB; Department of Industry, Innovation and Science (2019)

12.4 World production

Constrained copper mine production to increase market deficit

World copper mine production is expected to grow modestly in 2019, before lifting strongly in 2020. Mine production is forecast to grow at an average annual rate of 3.3 per cent over the outlook period, increasing from 21 million tonnes in 2018 to 23 million tonnes in 2021 (Figure 12.6).

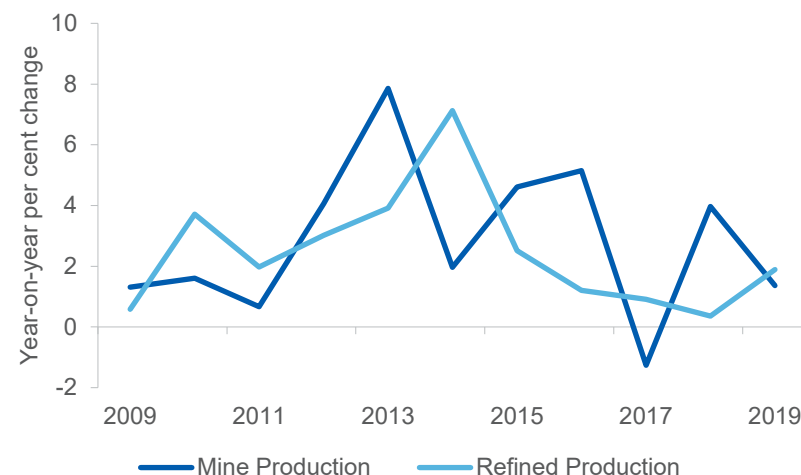
The deficit in the world markets is expected to grow over the outlook period. This is despite significant new production coming online. First Quantum's Cobre Panama mine, with a capacity of 340,000 tonnes has begun operations, and is expected reach 80 per cent capacity in the first half of this year. Higher production will also be supported by the completion of the Toquepala mine expansion in Peru. Annual production at the site is expected to increase by 52 per cent to 258,000 tonnes.

These (and other smaller production increases) are expected to offset decreased production in Indonesia and Zambia and weather disruptions elsewhere. Heavy rains in the March quarter reduced production at the Chuquicamata mine in Chile to the lowest level in over ten years. In June, the labour strikes halted production at the mine, which had not been resolved at the time of writing. A maintenance shut-down at the Qinghai Copper mine in China is also expected to affect production slightly in 2019.

Stronger copper prices are likely to be important in coming years to incentivise investment in new production, which will be needed to address the market deficit if consumption increases as expected (Figure 12.3).

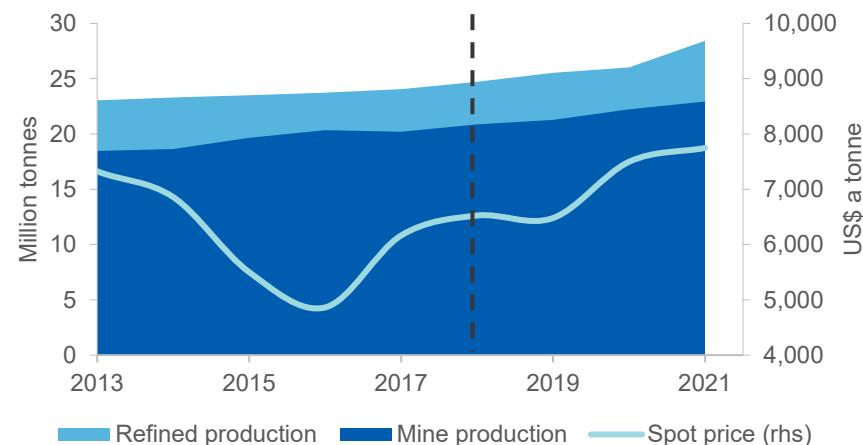
Refined copper production is expected to increase in 2019, as output returns to normal after the numerous outages and shutdowns of 2018. Output of refined copper is forecast to increase by an average rate of 2.7 per cent a year to reach 26 million tonnes in 2021, primarily supported by new refinery capacity in China. However, shortages in concentrate supply and tightening environmental restrictions may limit future production growth.

Figure 12.5: Change in output of mined and refined copper



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

Figure 12.6: World copper production and prices



Source: World Bureau of Metal Statistics (2019); Department of Industry, Innovation and Science (2019)

12.5 Australia

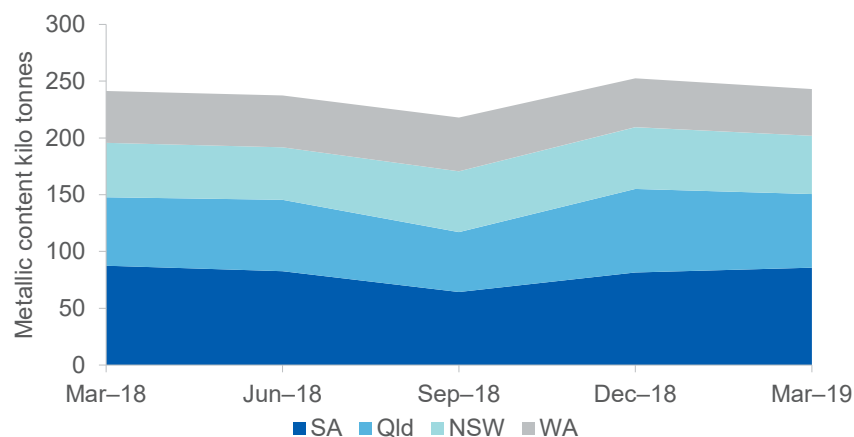
Mine production will be supported by rising output from existing mines

Australia's copper production is forecast to rise from 941,000 tonnes in 2017–18 to just over 1.0 million tonnes in 2020–21, growing at an average annual rate of 5.8 per cent. Higher output is expected to be driven by recovering production at BHP's Olympic Dam operations, following unexpected outages and scheduled maintenance at the end of 2018. Output will also be boosted by the start-up of OzMineral's Carrapateena mine in South Australia. Carrapateena has an annual production capacity of 4.3 million tonnes, and is expected to begin operations in the December quarter 2019.

Higher production supports growing copper exports

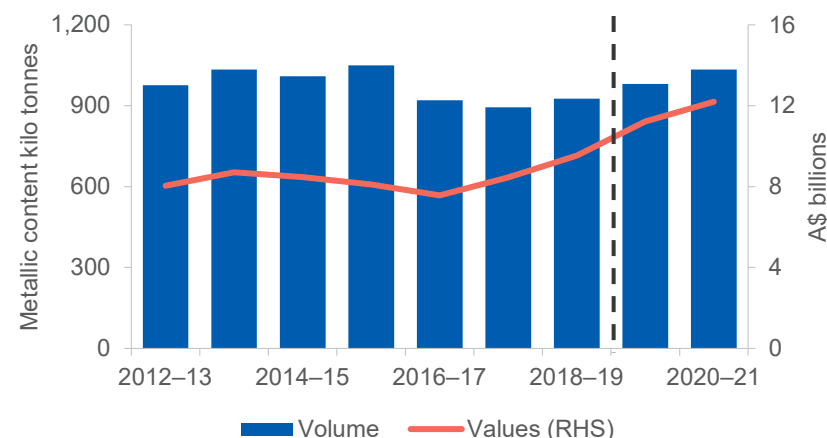
In line with higher production volumes, Australia's copper export earnings are forecast to increase from an estimated \$9.5 billion in 2018–19 to \$12 billion by 2020–21, growing at an average rate of 13 per cent a year (Figure 12.8). A moderately positive price outlook is also expected to support export earnings growth. However, this remains subject to a number of risks and uncertainties around the global copper price, as well as the outlook for global economic growth more broadly.

Figure 12.7: Australia's copper production by selected state



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

Figure 12.8: Australia's copper exports



ABS (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019).

Exploration activity continues to show strength

After showing consistent quarterly increases for the last two years, copper exploration activity decreased slightly in the March quarter 2019, to \$65 million.

Expenditure decreased in all major activity states, Queensland, New South Wales and South Australia. Despite this decrease, exploration activity is 42 per cent higher than the March 2018 quarter, and significantly higher than in recent years.

Revisions to the outlook

Australia's forecast copper export earnings for 2020–21 have been revised down by \$3.0 billion, driven by a less optimistic price outlook and changes in forecasts of production volumes.

Table 12.1: Copper outlook

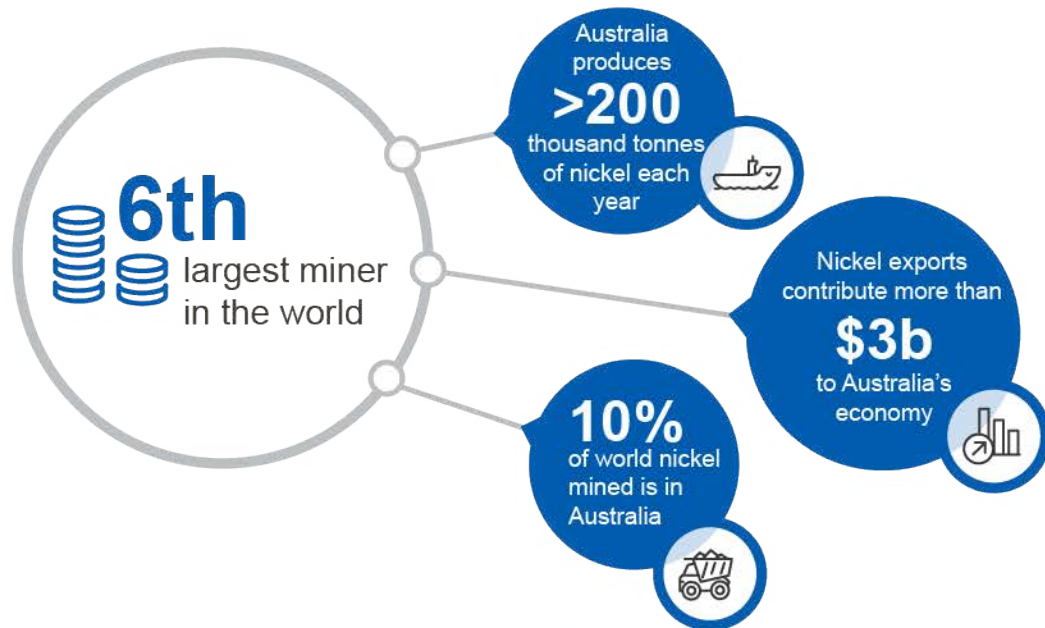
Annual percentage change								
World	Unit	2018	2019 ^s	2020 ^f	2021 ^f	2019 ^s	2020 ^f	2021 ^f
Production								
– mine	kt	20,789	21,282	22,229	22,939	2.4	4.5	3.2
– refined	kt	23,606	24,051	24,722	25,543	1.9	2.8	3.3
Consumption	kt	23,809	23,816	25,162	25,574	0.0	5.7	1.6
Closing stocks	kt	1 158	1 394	954	923	20.3	-31.6	-3.2
– weeks of consumption		2.5	3.0	2.0	1.9	20.3	-35.2	-4.7
Prices LME								
– nominal	US\$/t	6,525	6,480	7,498	7,748	-0.7	15.7	3.3
	USc/lb	296	294	340	351	-0.7	15.7	3.3
– real ^b	US\$/t	6,673	6,480	7,329	7,411	-2.9	13.1	1.1
	USc/lb	303	294	332	336	-2.9	13.1	1.1
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2018–19 ^s	2019–20 ^f	2020–21 ^f
Mine output	kt	876	941	1,003	1,036	7.4	6.6	3.3
Refined output	kt	369	417	395	398	12.9	-5.3	0.9
Exports								
– ores and cons. ^c	kt	1,987	1,985	2,226	2,422	-0.1	12.1	8.8
– refined	kt	317	370	346	348	16.8	-6.6	0.6
– total metallic content	kt	894	927	983	1 037	3.6	6.1	5.5
Export value								
– nominal	A\$m	8,451	9,511	11,221	12,198	12.5	18.0	8.7
– real ^d	A\$m	8,619	9,511	10,958	11,626	10.3	15.2	6.1

Notes: **b** In 2019 calendar year US dollars; **c** Quantities refer to gross weight of all ores and concentrates; **d** In 2018–19 financial year Australian dollars; **f** Forecast;

Source: ABS (2019) International Trade, 5465.0; LME (2019) spot price; World Bureau of Metal Statistics (2019) World Metal Statistics; Department of Industry, Innovation and Science (2019)

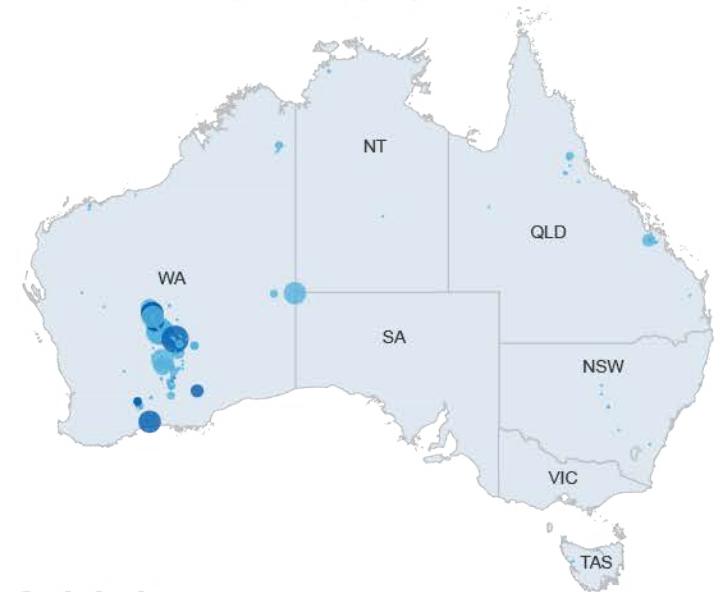
Nickel

Resources and Energy Quarterly June 2019



Major Australian nickel deposits (Mt)

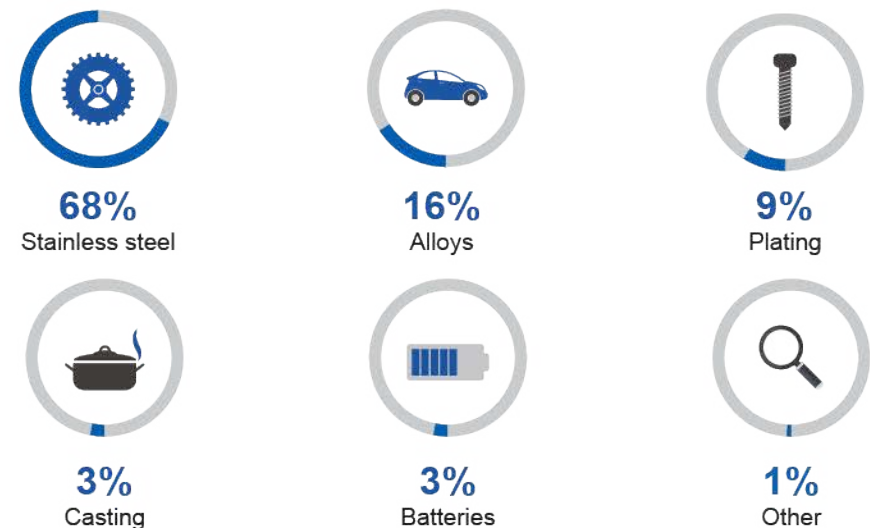
- <0.05
- 0.06–0.21
- 0.22–0.58
- 0.59–0.83
- 0.84–1.69
- >1.70
- Deposit
- Operating mine



Key nickel consumer markets (tonnes)



Global uses of nickel



13.1 Summary

- After increasing at the start of the year, nickel prices have recently fallen, as trade tensions continue to weigh on prices. In 2019, prices are forecast average just over US\$12,800 a tonne, increasing over the outlook period to reach US\$14,400 a tonne by 2021.
- Investment in new mines and capacity expansions, particularly in Western Australia, are expected to support higher production. Mine production is forecast to grow at an average 11 per cent a year to 2020–21. Refined production is forecast to increase an average 10 per cent a year, reaching 145,000 tonnes in 2020–21.
- Australia's total nickel export earnings are forecast to increase from \$3.5 billion in 2018–19 to \$5.0 billion in 2020–21, supported by expanding production and, to a lesser extent, higher prices.

13.2 Prices

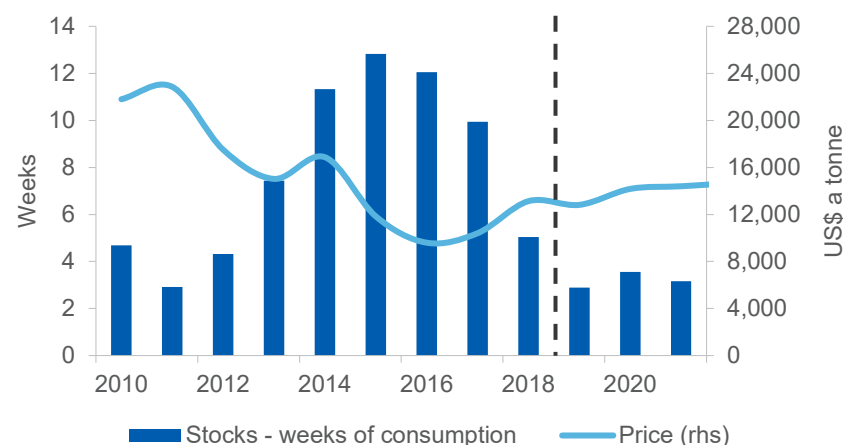
Nickel prices continue to fall, but tightening conditions point to a recovery

Despite decreasing stock levels, nickel prices have trended lower in the June quarter. Uncertainties linked to US-China trade tensions and increased low-grade production from China all contributed to the price falls. In the first five months of the year, the average LME spot price was US\$12,431 a tonne, 7.5 per cent lower than the same period in 2018.

Over the outlook period, world consumption growth is expected to outpace production growth, drawing on stock levels and leading to a greater deficit in the world. Prices are forecast to average just over US\$12,800 a tonne in 2019, lower than 2018, before rising in subsequent years to reach US\$14,400 a tonne in 2021 (Figure 13.1). There is potential for nickel consumption to boom, as electric vehicle battery manufacturing picks up and technological advances are married with market developments, supportive policy and changing consumer preferences.

Growing consumption is expected to be the dominant driver in nickel prices over the outlook period. However, in recent months the US-China trade tensions have placed downward pressure on prices. Slowing stainless steel consumption in China poses a significant risk to the outlook.

Figure 13.1: Nickel LME spot price and inventories



Source: Bloomberg (2019) London Metal Exchange; International Nickel Study Group (2019); Department of Industry, Innovation and Science (2019).

13.2 World consumption

Strong outlook for nickel consumption in existing and emerging markets

Growing stainless steel production and, to a lesser extent, battery manufacturing, are expected to support strong consumption growth over the outlook period. World consumption is forecast to increase from 2.3 million tonnes in 2018 to 2.7 million tonnes in 2021, growing at an average rate of 4.7 per cent a year. Healthy growth is expected in the largest consumer markets, increasing by 2.1 per cent in China, 1.8 per cent in Japan and 8.0 per cent in Indonesia. This will add a combined 125,000 tonnes to world consumption over the outlook period.

Nickel used in batteries is a small but growing market, currently accounting for about 3 per cent of nickel consumption. Changes in battery technology that improve the longevity and cost profile of batteries are likely to lift the proportion of nickel used in batteries, which combined with significantly higher battery production, is expected to open new opportunities for nickel producers from the 2020s onwards.

13.3 World production

Indonesia's export ban comes to fruition as capacity increases

World mine production is forecast to grow from 2.4 million tonnes in 2018 to 2.8 million tonnes in 2021, increasing by an average rate of 5.9 per cent a year. New capacity in Indonesia, which accounts for around a quarter of mined nickel production is expected to support world growth (Figure 13.2). Mined production from the Philippines, which contributes around 15 per cent of world production, is expected to lift as operations resume from recent closures. At the time of writing, severe rain and flooding in Indonesia had temporarily closed mine capacity, which may impact 2019 production.

World refined production is forecast to reach 2.7 million tonnes in 2021, increasing at an average rate of 6.8 per cent a year from 2.2 million tonnes in 2018. Indonesia's productive capacity has seen significant investment since export bans were imposed in 2014, which encouraged foreign investment to secure supply and expand domestic refining capacity. The latest project to come online — Delong Holding's Konawe project — is preparing for start-up, and will contribute an additional 132,000 tonnes per year, utilising innovative technology to produce nickel sulphate for battery manufacturing.

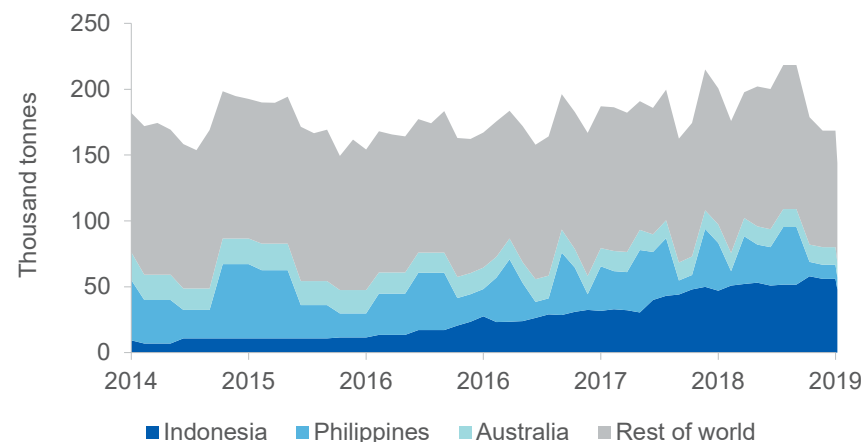
After the current wave of projects in Indonesia come online, the outlook is not as bright, as weak nickel prices have stifled prospective investments. Greenfield refinery projects are limited, and this may lead to production shortages as consumption grows.

13.4 Australia

Investment activity to support Australia's production growth

Australia's nickel production has increased in the March quarter, as operations recovered from low output in 2018 and as new capacity came online. Panoramic Resources' Savanah mine and processing facilities in WA began operations in the March quarter.

Figure 13.2: World mined nickel production, monthly



Source: International Nickel Study Group (2019)

Figure 13.3: Australia's quarterly nickel production



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

Australia's mine production is forecast to reach 212,000 tonnes in 2020–21, up from 150,000 tonnes in 2018–19 (Figure 13.3). A renewed interest in nickel production has supported significant recent investment in Australian projects. New production from BHP's Nickel West project in WA — including the start-up of the Yakabindie operation — is expected by the end of the year.

A number of smaller mines are considering start-up or recommissioning over the next few years, with nickel prices to be a decisive factor.

Higher export earnings to be supported by growing production

Growing production volumes and increasing prices are expected to support higher export earnings over the outlook period. Australia's nickel exports are forecast to grow at an average annual rate of 11 per cent a year, from \$3.5 billion in 2018–19 to \$5.0 billion in 2020–21 (Figure 13.4).

This growth is primarily supported by expected higher prices, however export volumes are expected to increase steadily over the outlook. Export volumes are forecast to increase from 221,000 tonnes in 2018–19 to 291,000 tonnes in 2020–21.

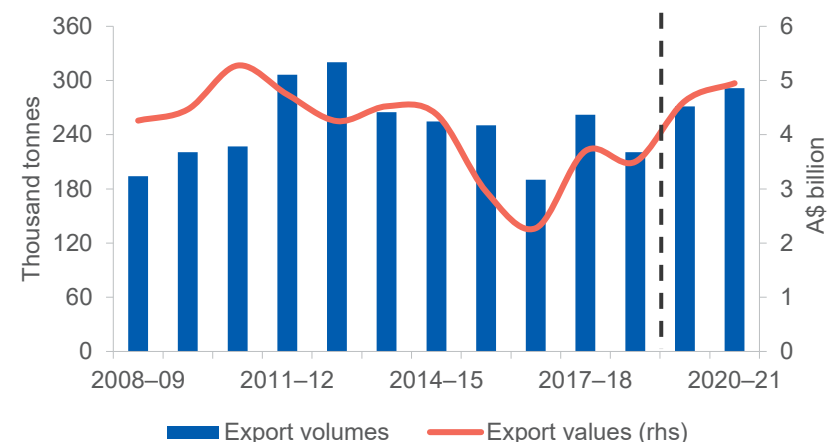
Exploration activity continues on motivation of battery manufacturing

Nickel and cobalt exploration was \$49 million in the March quarter, consistent with December quarter (Figure 13.5). Exploration activity picked up in late 2017 and has remained strong as market interest in nickel and cobalt rise on prospective expectations about new applications and expanding markets.

Revisions to the outlook

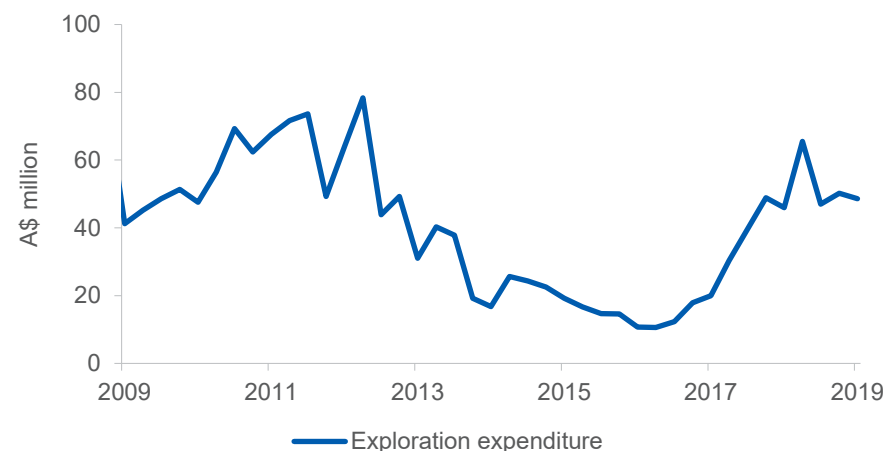
Forecasts for Australia's nickel export earnings have been revised up significantly since the March 2019 *Resources and Energy Quarterly*. Export earnings for 2019–20 and 2020–21 have been revised up by \$0.7 billion and \$0.8 billion respectively, informed by forecasts of higher production and stronger than expected export activity.

Figure 13.4: Australia's nickel export volumes and values



Source: ABS (2019) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2019)

Figure 13.5: Australian nickel and cobalt exploration expenditure, quarterly



Source: ABS (2019) Mineral and Petroleum Exploration 8412.0

Table 13.1: Nickel outlook

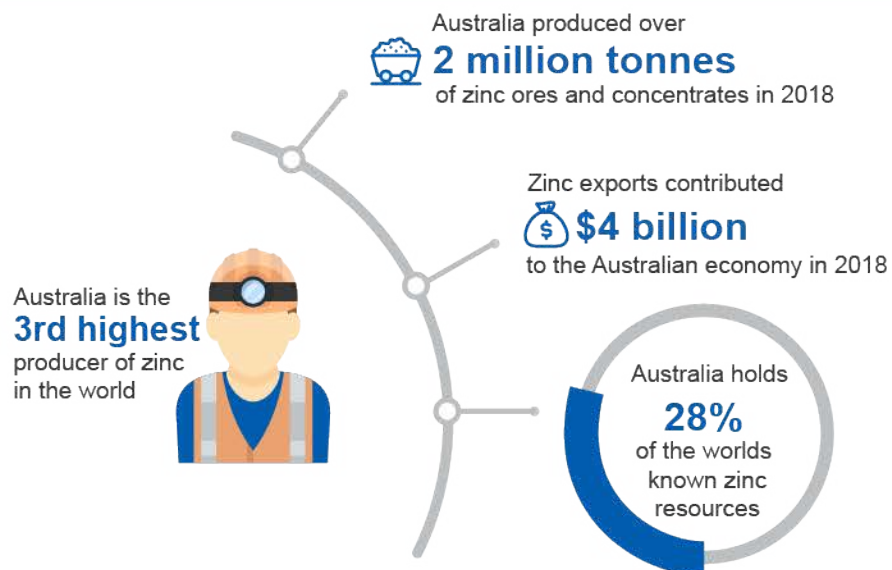
Annual percentage change								
World	Unit	2018	2019 ^s	2020 ^f	2021 ^f	2019 ^s	2020 ^f	2021 ^f
Production								
– mine	kt	2,350	2,562	2,736	2,789	9.0	6.8	2.0
– refined	kt	2,182	2,379	2,604	2,655	9.0	9.5	2.0
Consumption	kt	2,327	2,467	2,566	2,668	6.0	4.0	4.0
Stocks	kt	225	137	175	162	-39.2	28.2	-7.6
– weeks of consumption		5.0	2.9	3.6	3.2	-42.7	23.2	-11.2
Price LME								
– nominal	US\$/t	13,133	12,817	14,175	14,400	-2.4	10.6	1.6
	Usc/lb	596	581	643	653	-2.4	10.6	1.6
– real ^b	US\$/t	13,431	12,817	13,856	13,775	-4.6	8.1	-0.6
	Usc/lb	609	581	629	625	-4.6	8.1	-0.6
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2018–19 ^s	2019–20 ^f	2020–21 ^f
Production								
– mine ^{cs}	kt	160	150	167	212	-5.9	11.2	26.9
– refined	kt	109	112	140	145	2.9	24.7	3.4
– intermediate		27	8	16	16	-70.0	100.0	0.0
Export volume ^{ds}	kt	262	221	271	291	-15.8	23.0	7.4
– nominal value ^s	A\$m	3,701	3,500	4,621	4,950	-5.4	32.0	7.1
– real value ^{es}	A\$m	3,775	3,500	4,513	4,718	-7.3	28.9	4.5

Notes: **b** In 2019 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 2018–19 financial year Australian dollars; **f** Forecast,

Source: ABS (2019) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Innovation and Science; International Nickel Study Group (2019); LME (2019); World Bureau of Metal Statistics (2019)

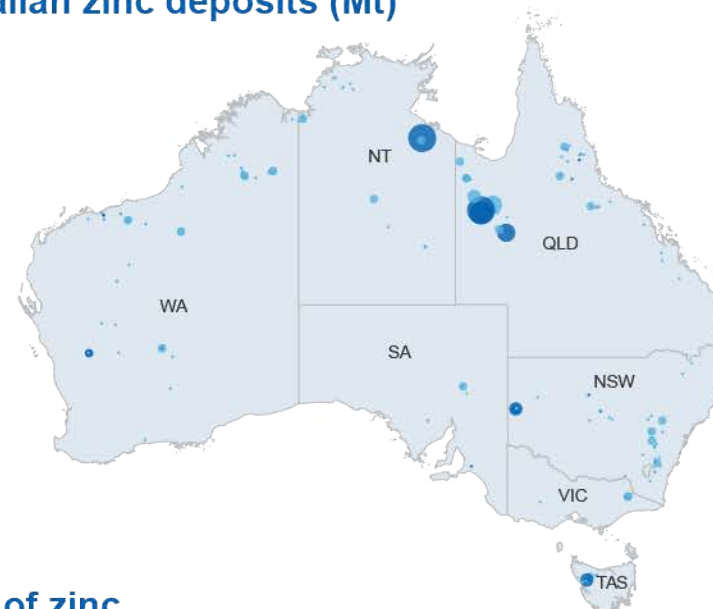
Zinc

Resources and Energy Quarterly June 2019

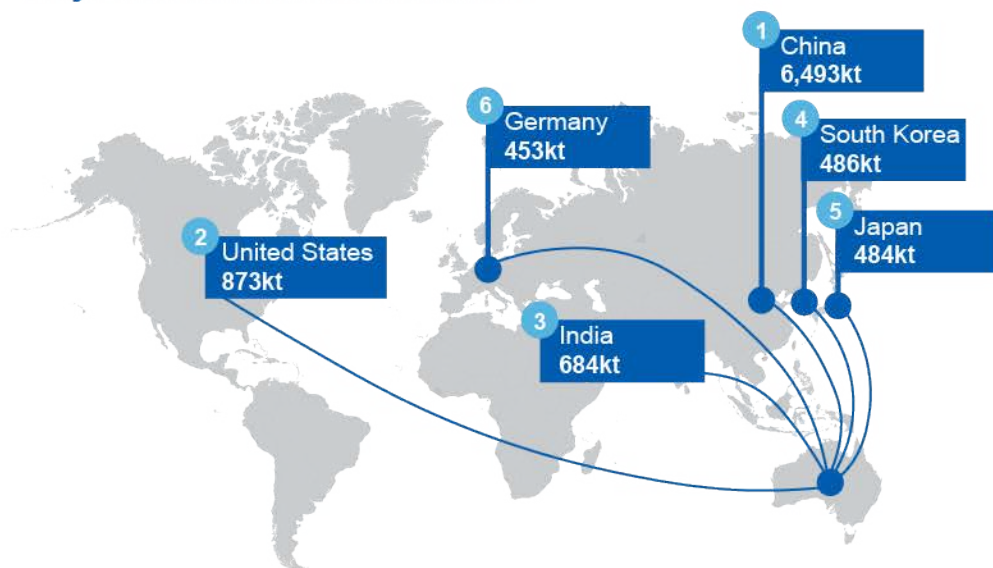


Major Australian zinc deposits (Mt)

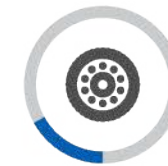
- <0.01
- 0.02–0.03
- 0.04–0.09
- 0.10–0.20
- 0.21–0.44
- >0.45
- Deposit
- Operating mine



Key zinc consumer markets



Global uses of zinc



14.1 Summary

- Zinc prices are forecast to edge back from their recent minor peak in the first half of 2019 — falling from US\$2,780 in 2019 to US\$2,500 in 2021 — as supply closes the gap with demand.
- Australia's production is forecast to peak in 2019–20, as production ramps up at the re-opened Century mine in Queensland, before declining again as a mix of smaller mines hit lower grades and some reach end of life. Export volumes (in metallic content terms) are forecast to peak at 1.51 million tonnes in 2019–20 — then taper lower to 1.46 million tonnes in 2020–21.
- The value of Australia's zinc exports is forecast to decline from \$4.2 billion in 2018–19 to \$3.5 billion in 2020–21, due to softer prices.

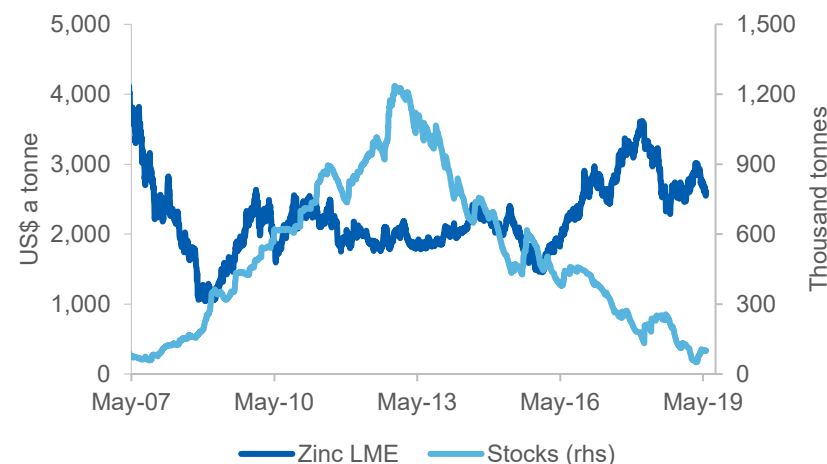
14.2 Prices

Prices to decline over the outlook period

The London Metal Exchange (LME) zinc spot price briefly breached US\$3,000 a tonne in early April 2019, but has since drifted lower as a result of subdued demand, to average US\$ 2,845 a tonne in the June quarter (Figure 14.1). This is 8.6 per cent lower year-on-year. Inventories have remained tight, with LME stocks reaching 11-year lows during May 2019, and Shanghai Futures Exchange (SHFE) inventories declining to historical lows, after a temporary rebound in the March quarter 2019. The low level of zinc inventory is attributed to lower smelter output levels in China and Europe over the period, and is expected to keep the price elevated in the short term.

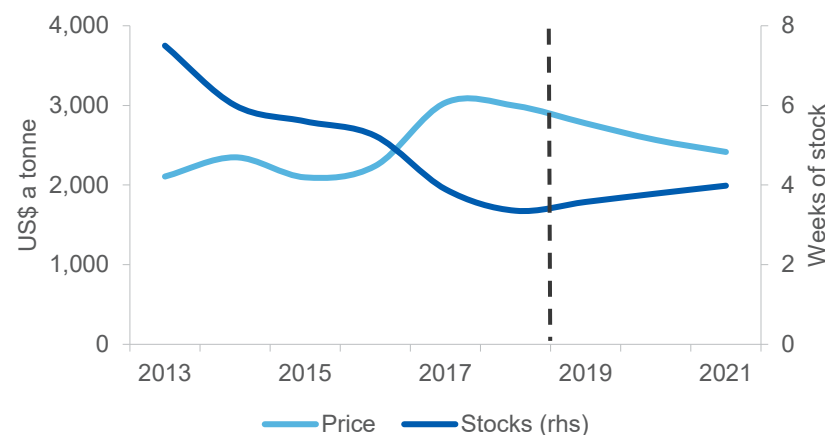
The LME zinc spot price is forecast to average US\$2,780 per tonne during 2019 (Figure 14.2). Beyond 2019, prices are forecast to decline by an annual average of 5.2 per cent, down to US\$2,500 per tonne in 2021. Lower prices will be driven by rising concentrate production and a steady increase in inventory levels, as the market returns to a healthy surplus in 2020 and 2021.

Figure 14.1: Historical zinc prices and stocks



Source: London Metal Exchange (2019) and Department of Industry, Innovation and Science (2019)

Figure 14.2: Forecast for zinc prices and stocks



Source: London Metal Exchange (2019) and Department of Industry, Innovation and Science (2019)

14.3 World consumption

Global refined zinc consumption is forecast to rise moderately over the outlook period, from 13.8 million tonnes in 2019 to 14.3 million tonnes in 2021 (Figure 14.2). Zinc's primary use is galvanizing steel, so consumption is expected to move with steel use which is forecast to rise over the outlook (see the *steel* chapter).

China — which accounts for around half of global zinc and steel consumption — faces a slowing economy over the outlook period, and much uncertainty relating to trade policy with the US. The imposition of US tariffs on a number of imported Chinese goods has the potential to decrease Chinese zinc demand, as export goods containing zinc or galvanized steel become more expensive for US consumers. The trade impact will potentially be offset by measures taken by the Chinese government to boost domestic growth using higher infrastructure spending.

Nonetheless, higher (steel and) zinc consumption is forecast to benefit from stronger growth stemming from India and other emerging economies. India has ambitious targets to increase domestic steel production over the outlook, and its demand for zinc is forecast to grow by 7.6 per cent annually to 850 million tonnes in 2021.

14.4 World production

Mine output to rise over the outlook period

Global mine production increased by 1.8 per cent year-on-year in the four months to April 2019, and is forecast to rise over the rest of 2019 as several new mines and expansions ramp up production. The market balance is expected to return to surplus by the end of 2019.

World mine production is forecast to grow at an annual average rate of 4.1 per cent from 13 million tonnes in 2018 to reach 14 million tonnes in 2021. Major mine projects coming online during the outlook period include the 100,000 tonne per annum (ktpa) capacity Yunnan Hualian project in China (expected to commence production in 2020), as well as several large expansion projects in India set to add 80,000 tonnes of capacity in 2019.

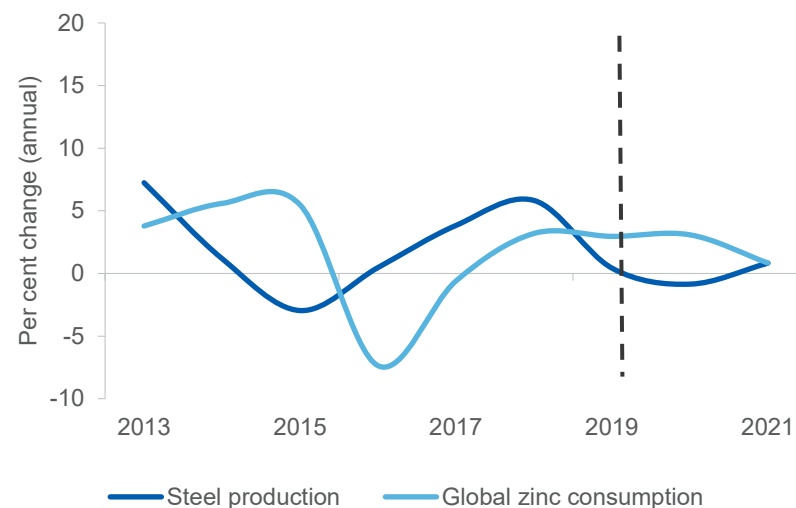
Australia — the world's third largest mine producer — also has significant mine capacity ramping up over the outlook period (Section 14.5).

Refined production to lift with mine output

Refined production decreased by 3.0 per cent year-on-year in the March quarter driven by environmental restrictions during China's winter period. However, output is expected to ramp up over the remainder of 2019.

Refined output is forecast to grow at an annual average rate of 3.2 per cent from 13 million tonnes in 2018 to 14 million tonnes in 2021. Rising production will be led by China — the world's largest producer — which is forecast to grow its output at an average annual rate of 3.1 per cent, reaching 6.3 million tonnes in 2021. While zinc production in China is dispersed across hundreds of smaller operations, the Yunnan Hualian operations are a notable addition, expected to produce 100,000 tonnes commencing in 2020.

Figure 14.3: Annual change in global steelmaking and zinc use



Source: International Monetary Fund (2018), Department of Innovation, Industry and Science (2019) estimates

14.5 Australia

Zinc exports are expected to grow in line with rising production

Export earnings are forecast to decrease from an estimated \$4.2 billion in 2018–19 to \$3.5 billion in 2020–21, driven by moderating prices. Volumes (in metallic content terms) are forecast to peak in 2019–20 and taper in 2020–21, returning to 2018–19 levels.

Export volumes (total metallic content) increased strongly by 17 per cent in the March quarter, to 313,000 tonnes, driven by the ramp up in production stemming from MMG's Dugal river project and the New Century mine. Export volumes (in metal content terms) are estimated to have risen strongly by 24 per cent year-on-year in 2018–19, boosted by the reopening of the Mt Isa railway — which provides haulage for nearly half Australia's production.

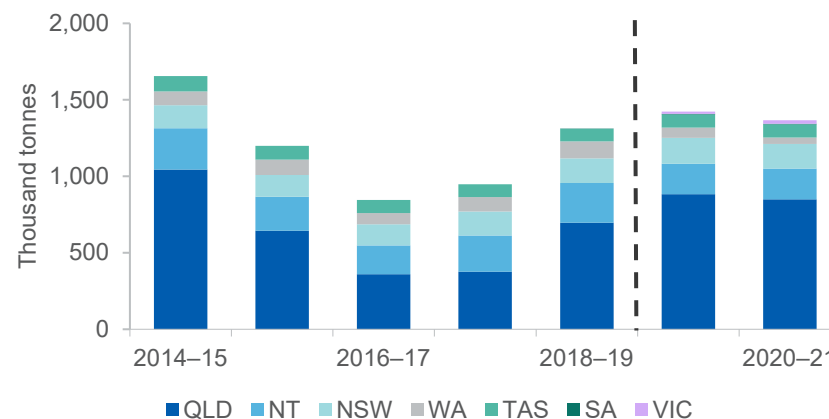
Australian mined production increasing

Australia's zinc production increased by 33 per cent year-on-year during the March quarter 2019 — to 317,000 tonnes (in metal content terms). Mine production is forecast to reach a five year peak at 1.4 million tonnes in 2019–20. The increase will be driven by the ramp up of Glencore's Lady Loretta mine, MMG's Dugal river mine and the re-opening of New Century Resources' mine, all in Queensland. The Thalana zinc project in Queensland restarted in the March quarter 2019, and is producing at a higher-than-expected rate due to exceptional recoveries and concentrate grades. This may provide additional upside to production over the outlook period.

Slow start to exploration expenditure in 2019

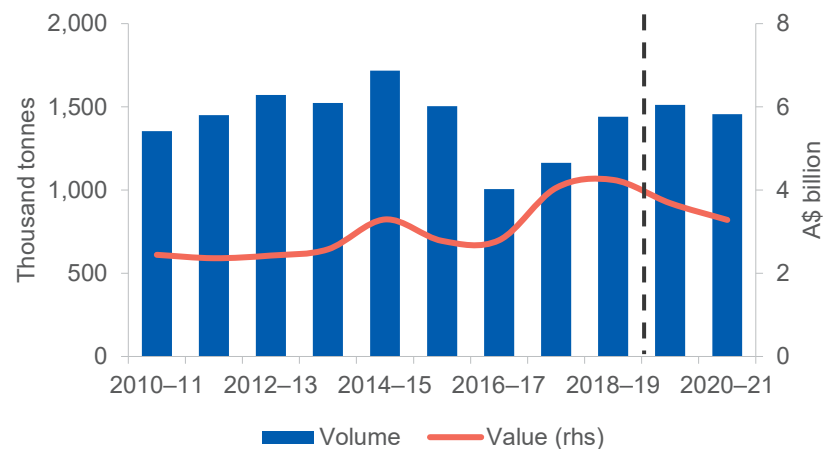
Exploration spending for silver, lead and zinc declined by 12 per cent year-on-year to \$16 million in the March quarter 2019, despite elevated prices. With zinc prices expected to decline from historically high levels, exploration spending is expected to remain subdued over the outlook period.

Figure 14.4: Australia's zinc production by state



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

Figure 14.5: Australia's zinc exports, metallic content



Source: ABS (2019) International Trade in Goods and Services, 5368.0, Department of Innovation, Industry and Science (2019)

Table 14.1: Zinc outlook

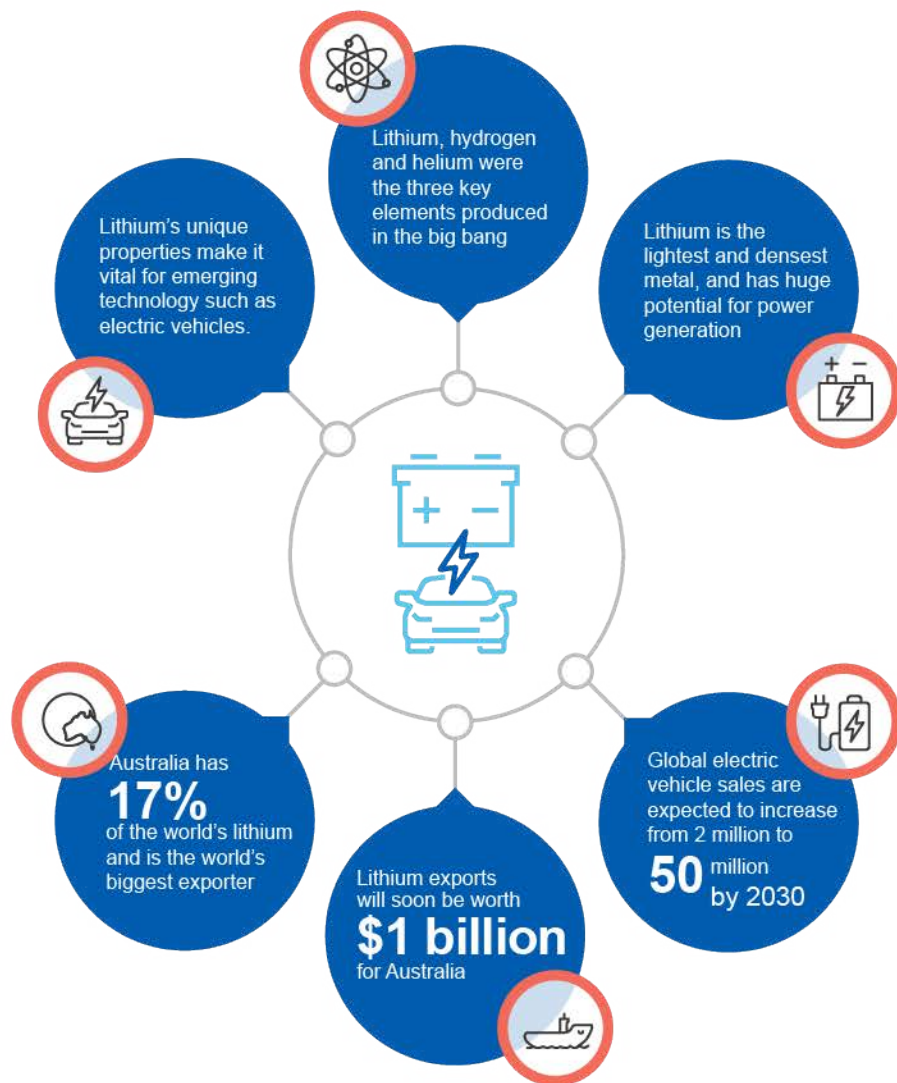
Annual percentage change								
World	Unit	2018	2019 ^f	2020 ^f	2021 ^f	2019 ^f	2020 ^f	2021 ^f
Production								
– mine	kt	12,691	13,480	14,239	14,297	6.2	5.6	0.4
– refined	kt	13,171	13,649	14,150	14,435	3.6	3.7	2.0
Consumption	kt	13,682	13,770	14,047	14,333	0.6	2.0	2.0
Closing stocks	kt	894	773	875	977	-13.5	13.2	11.7
– weeks of consumption		3	3	3	4	-14.1	11.0	9.5
Price								
– nominal	US\$/t	2,925	2,780	2,640	2,500	-5.0	-5.1	-5.3
	USc/lb	133	126	120	113	-5.0	-5.1	-5.3
– real ^b	US\$/t	2,992	2,780	2,580	2,391	-7.1	-7.2	-7.3
	USc/lb	136	126	117	108	-7.1	-7.2	-7.3
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2018–19 ^s	2019–20 ^f	2020–21 ^f
Mine output	kt	949	1,313	1,424	1,367	38.4	8.5	-4.0
Refined output	kt	474	485	475	478	2.4	-2.1	0.6
Export volume								
– ore and concentrate ^c	kt	1,738	2,382	2,748	2,612	37.1	15.3	-5.0
– refined	kt	417	410	333	337	-1.8	-18.6	1.2
– total metallic content	kt	1,164	1,437	1,510	1,457	23.5	5.1	-3.6
Export value								
– nominal	A\$m	3,973	4,171	3,954	3,458	5.0	-5.2	-12.5
– real ^d	A\$m	4,053	4,171	3,861	3,296	2.9	-7.4	-14.6

Notes: **b** In 2019 US dollars; **c** Quantities refer to gross weight of all ores and concentrates; **d** In 2018–19 Australian dollars; **f** Forecasts; **s** Estimate.

Source: ABS (2019) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Innovation and Science; International Lead Zinc Study Group (2019); LME (2019); World Bureau of Metal Statistics (2019)

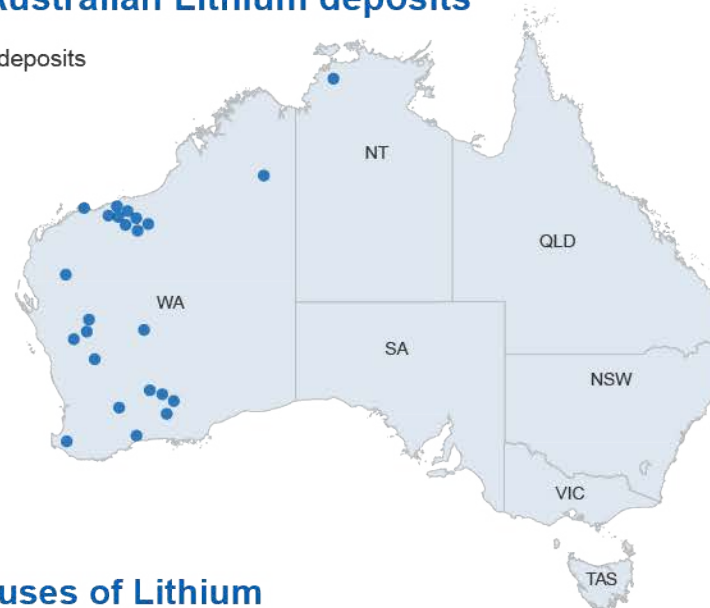
Lithium

Resources and Energy Quarterly June 2019

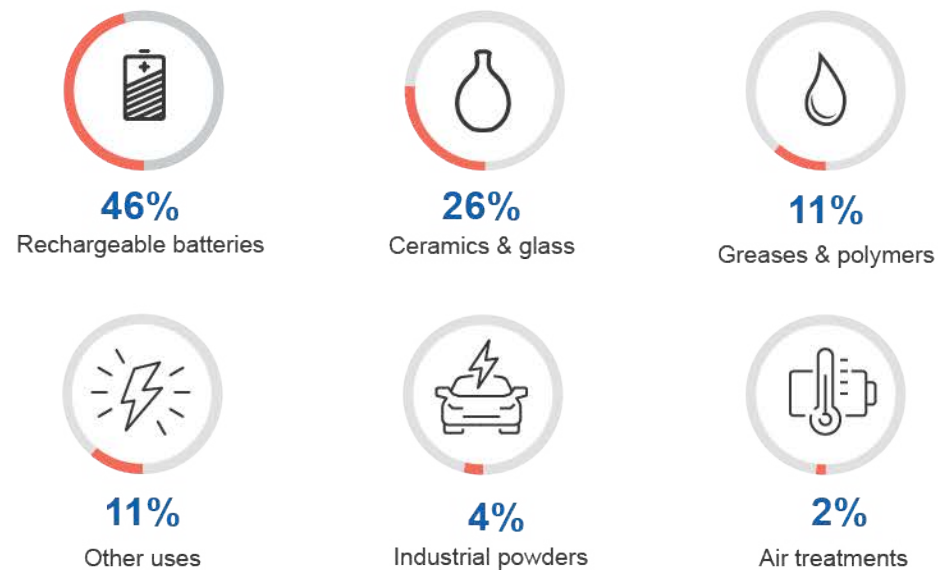


Major Australian Lithium deposits

● Lithium deposits



Global uses of Lithium



15.1 Summary

- The lithium hydroxide price is expected to ease from \$US16,139 a tonne in 2018 to around US\$14,080 in 2019. Prices are expected to fall further in 2020 before recovering slightly, to US\$12,500 in 2021.
- Australian lithium production is expected to increase from an estimated 272,266 tonnes (in lithium carbonate equivalent terms) in 2018–19 to around 335,000 tonnes by 2020–21, as the Greenbushes mine is upgraded and several newer mines ramp up.
- Rising production and new value-adding refineries are forecast to push export revenue up to \$1.4 billion by 2020–21.

15.2 Prices

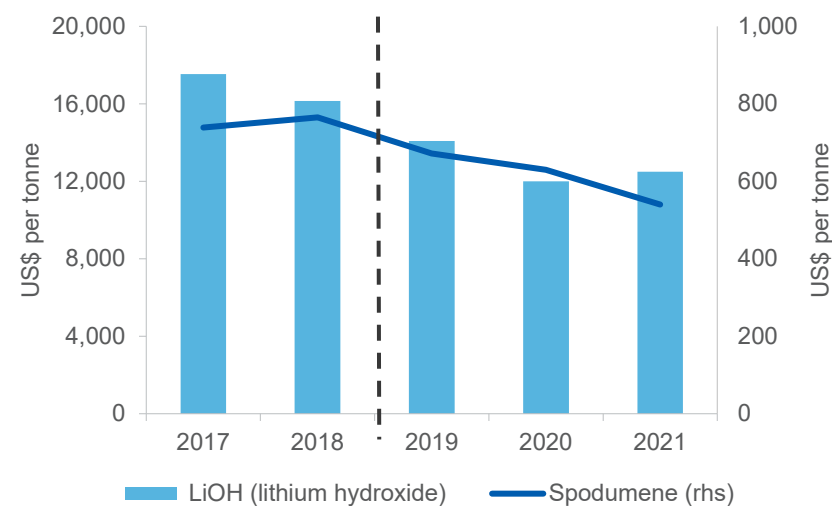
Lithium prices are expected to keep falling in the short term

Lithium hydroxide prices have been trending down since their peak in late 2018. The fall in prices has been led by China, where price drops have been large enough to more than offset stable or rising prices in other countries. In recent months spot prices have fallen more sharply than contract prices, with the latter responding more slowly to oversupply.

Lithium hydroxide prices are projected to fall by around 15 per cent in 2019, as oversupply persists and inventories grow. Over the outlook period, the supply surplus is projected to gradually close, with the price expected to start turning around after 2020 (Figure 15.1). Spodumene ore — the precursor material for lithium hydroxide — is expected to face a longer period of oversupply, with prices remaining soft through the whole outlook period.

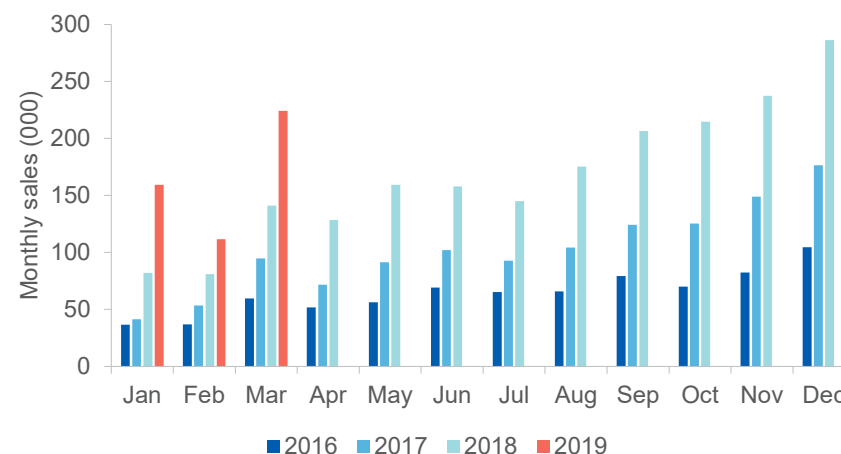
The present lithium oversupply is a side effect of miners attempting to position output to meet an expected rapid rise in future demand. Electric vehicle (EV) sales have risen by more than 50 per cent relative to the same point in 2018, and the rate of growth is accelerating (Figure 15.2). The fact that supply is being triangulated against future demand makes it somewhat unlikely that oversupply will correct in the very near future. However, demand growth is likely to outstrip supply by around 2023.

Figure 15.1: Comparative price, spodumene ore / lithium hydroxide



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

Figure 15.2: Monthly electric vehicle sales



Source: Inside EVs (2019) Monthly Sales Scorecard. Based on reconciled monthly or quarterly total sales data reported by major plug-in automakers.

15.3 World consumption

Lithium supply chains are becoming more mature

Global lithium imports (and consumption) have lifted significantly in the first quarter of 2019, mirroring a spike at the start of 2018. If the trend continues to follow that of the previous year, some easing is likely to have occurred in the June quarter, which may add to price deflation in mid-year.

Japan is currently the largest importer of refined lithium, ahead of South Korea. Japanese imports are linked to the country's emerging role as a producer of electric vehicle technology used by firms such as Panasonic and Tesla. Imports are drawn from Chinese suppliers, with lithium supply chains now solidifying between China, Japan, and markets in the EU and the US. A second supply chain — albeit smaller — is growing between Korean technology producers and suppliers in Chile and China.

These two supply chains are likely to become far more significant over time, with a complex network developing between new electric vehicle facilities in China, Germany, South Korea, and the US. Rising EV sales is expected to account for the vast majority of growth in lithium use for the foreseeable future (Figure 15.3).

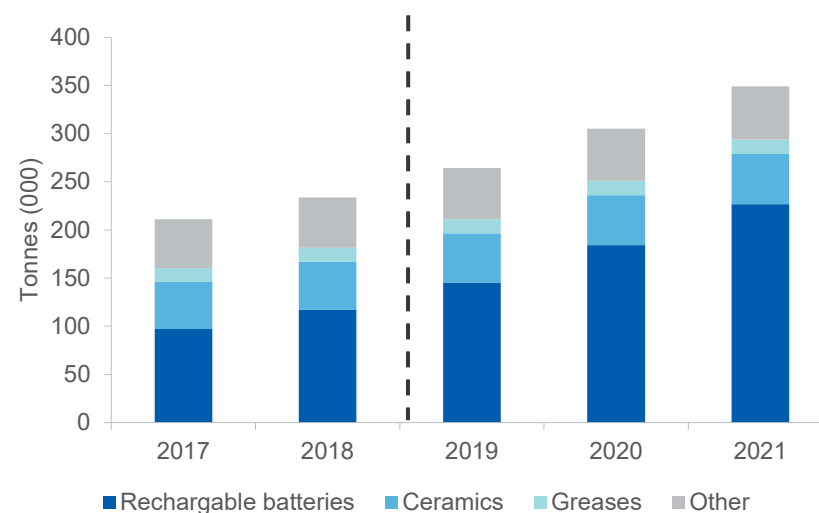
The ramp-up in electric vehicle and battery facilities is projected to lift lithium demand over the outlook period, from 234,000 tonnes in 2018 to more than 349,000 tonnes by 2021. EV sales are expected to rise further still beyond the outlook period (Figure 15.4) before flattening out at the end of the 2020s.

15.4 World production

Production chains are growing in volume and complexity

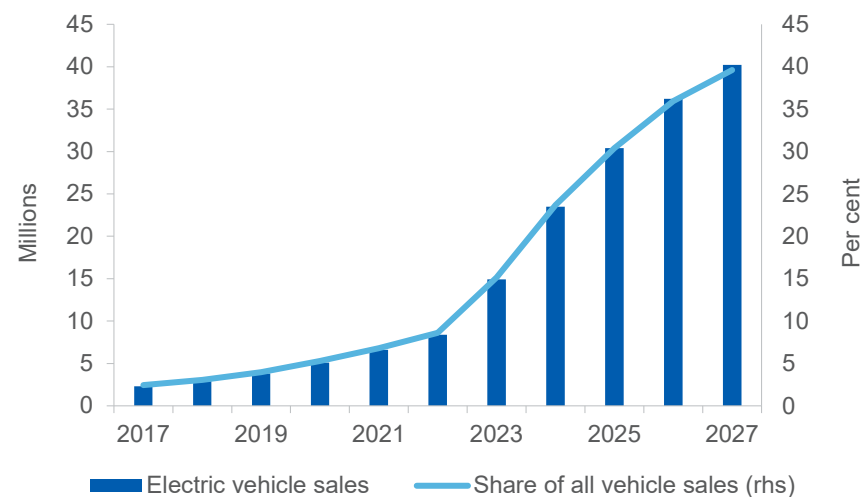
Lithium production chains are evolving rapidly, with a shift in the market towards the use of hard rock deposits. Lithium hydroxide produced by hard rock is more amenable to high-temperature sintering, which makes it more suitable for use in high-nickel products such as batteries. Hard rock production involves pulverising the ore to extract raw material, processing to produce concentrates, and mixing of concentrates with nickel, manganese and cobalt to produce oxides that combine with electrolytes.

Figure 15.3: Lithium usage by product



Source: Roskill (2019); Department of Industry, Innovation and Science (2019). 'Other' includes glass, powders, primary batteries, and air treatments.

Figure 15.4: Long-term electric vehicle sales projection



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

Many countries are investing in facilities to target each of these steps. European countries have announced an intention to bring as many of these production stages as possible into the EU, with China following a similar path. These investments should reduce the risk of future bottlenecks and support a more stable and integrated lithium market.

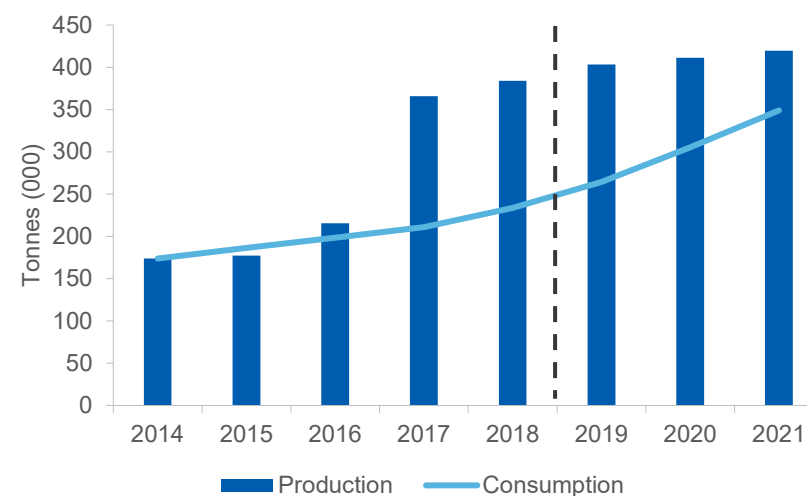
Hard rock lithium production is also benefiting from new problems with brine production, which competes with it. Although large reserves of lithium exist in brine in Chile and China (Figure 15.6), exploitation requires high volumes of water, which has made it contentious in some South American regions. SQM — a large brine producer — has recently been required to submit a \$US25 million environmental compliance plan, and has shut down a well deemed to be excessively affecting desert trees and vegetation. Albermarle has also been forced to halt engineering work at its La Negra project in Chile due to concerns over water usage.

Some brine facilities have progressed in recent months, with SQM receiving environmental approval for constructions at Salar de Atacama and Salar del Carmen in Chile. However, final approvals will take more time, and hard rock production is expected to dominate global growth over the outlook period, accounting for virtually all of the projected expansion from 384,000 tonnes in 2018 to 420,000 tonnes by 2021 (Figure 15.5).

In the longer term, lithium recycling is likely to start substituting for mined production. Recycling methods used for copper and lead have little application for lithium. However, Volkswagen Group has recently announced proposals to develop a cost-effective lithium recycling process. The Group plans to construct a custom-built facility to investigate lithium recycling methods by the end of 2019. The US Energy Department has also announced plans for a research centre to examine lithium-ion battery recycling. The facility has been granted initial funding of US\$15 million.

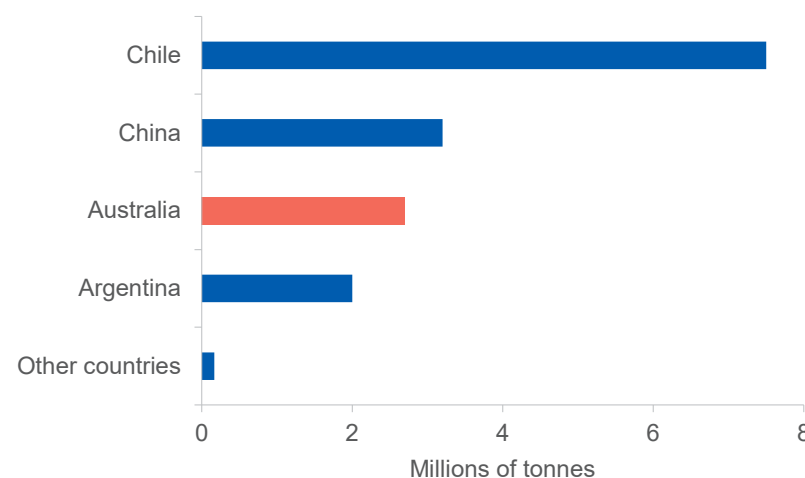
Large-scale lithium recycling is unlikely to occur much before 2030, when batteries start reaching end of life in large quantities. However, recycling plants may prove crucial in the long-term; not just as a means to reduce the material and energy cost of electric cars, but also to ensure long-term matching between lithium supply and demand.

Figure 15.5: Lithium production and use



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

Figure 15.6: Contained lithium reserves



Source: US Geological Survey (2018); Department of Industry, Innovation & Science (2019).

15.5 Australia

Production is expected to grow further over the next two years

Australian output dominated global growth in 2018, with production commencing at several sites in Western Australia. These include Pilbara Minerals' Pilgangoora mine, Altura Mining's Pilgangoora mine (albeit with disruptions from Cyclone Veronica), and Alliance Mineral Assets' Bald Hill operation. Production at the Bald Hill Mine rose strongly in the March quarter 2019, with growth of more than 20 per cent relative to the December quarter. Output of mineral concentrates from the mine is expected to have passed 30,000 tonnes in the March quarter.

Pilbara's Pilgangoora mine appears to have more potential than previously expected. In March Pilbara released the results of a study suggesting that its planned phase 3 expansion will produce around 1,200 tonnes of spodumene concentrate each year for around 15 years. Operating costs for the site — estimated at US\$291 per tonne — are relatively modest and below current prices. Galaxy Resources has also announced an upgrade on its earlier estimate of mineral deposits at the Mt Cattlin mine.

New production (and a ramp up from mines completed in 2018) should see output rise over the outlook period. Talison Lithium's expanded Greenbushes mine is set to add significantly to output growth over the next year. Overall spodumene production is estimated to have reached 272,000 tonnes in 2018–19, and is forecast to hit 335,000 tonnes by 2020–21.

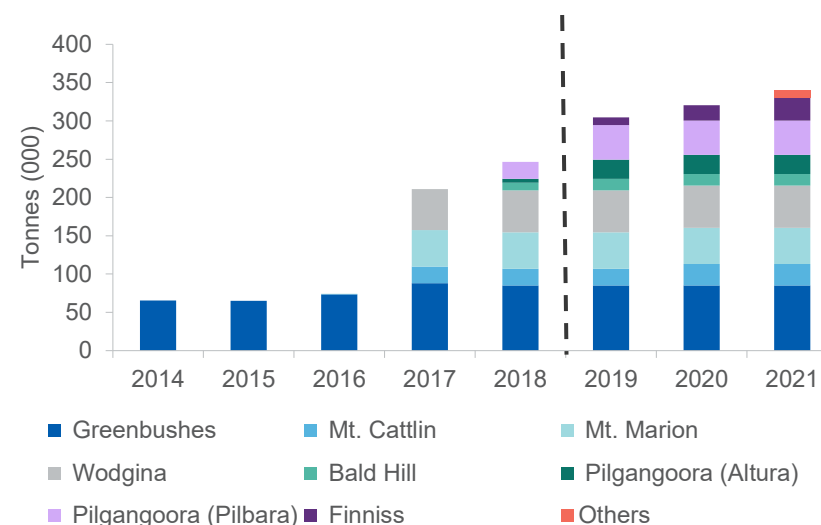
Exports are set to grow strongly over the outlook period

Export volumes are projected to track with production, since Australia currently has no domestic use of spodumene. Falling prices will create headwinds for export values in the short-term, though construction of hydroxide refineries should add to export values late in the outlook period. Export values are projected to reach \$1.4 billion by 2020–21 (Figure 15.8).

Revisions to the outlook

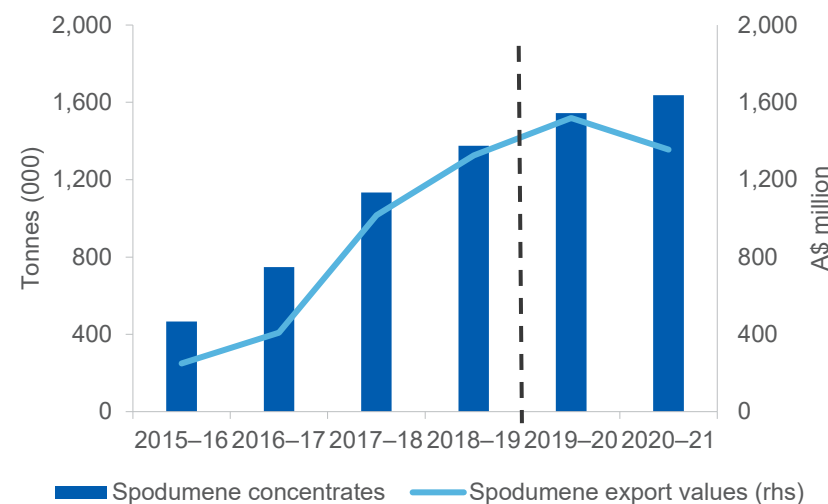
Australia's export earnings forecasts have not been revised significantly from those in the March 2019 *Resources and Energy Quarterly*.

Figure 15.7: Australian spodumene ore production (LCE*)



Source: Company reports, Roskill (2019); Department of Industry, Innovation and Science (2019). *LCE denotes lithium carbonate equivalent measure.

Figure 15.8: Australian spodumene exports



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

Table 15.1: Lithium outlook

World	Unit	Annual percentage change						
		2018	2019 ^f	2020 ^f	2021 ^f	2019 ^f	2020 ^f	2021 ^f
Lithium production ^a	kt	384	403	411	420	5.0	2.0	2.0
Consumption	kt	234	264	305	349	13.1	15.4	14.4
Stocks	kt	533	672	778	849	26.0	15.8	9.1
– weeks of consumption		118.6	132.2	132.6	126.5	11.4	0.4	-4.6
Spodumene price								
– nominal	US\$/t	765	672	630	540	-12.2	-6.3	-14.3
– real ^b	US\$/t	782	672	616	517	-14.1	-8.4	-16.1
Lithium hydroxide price								
– nominal	US\$/t	16,139	14,080	12,000	12,500	-12.8	-14.8	4.2
– real ^b	US\$/t	16,505	14,080	11,730	11,957	-14.7	-16.7	1.9
Australia	Unit	2017–18	2018–19 ^s	2019–20 ^f	2020–21 ^f	2018–19 ^s	2019–20 ^f	2020–21 ^f
Mine production ^a	kt	251	272	318	335	8.5	17.0	5.0
Export volume ^c	kt	1 134	1 376	1 545	1 638	21.3	12.3	6.0
– nominal value ^s	A\$m	1,016	1,327	1,519	1,355	30.6	14.5	-10.8
– real value ^{bs}	A\$m	1,020	1,327	1,483	1,291	30.1	11.8	-13.0

Notes: **a** Lithium Carbonate Equivalent. This is a measure of the quantity of refined product produced from spodumene ore. **b** In 2019 calendar year US dollars; **c** Spodumene concentrates; **f** Forecast; **s** Estimate; **r** Compound annual growth rate

Sources: Department of Industry, Innovation and Science (2019); Company reports; Roskill (2019); Government of Western Australia Department of Mines, Industry Regulation and Safety (2019)

The Australian gold industry

Resources and Energy Quarterly June 2019

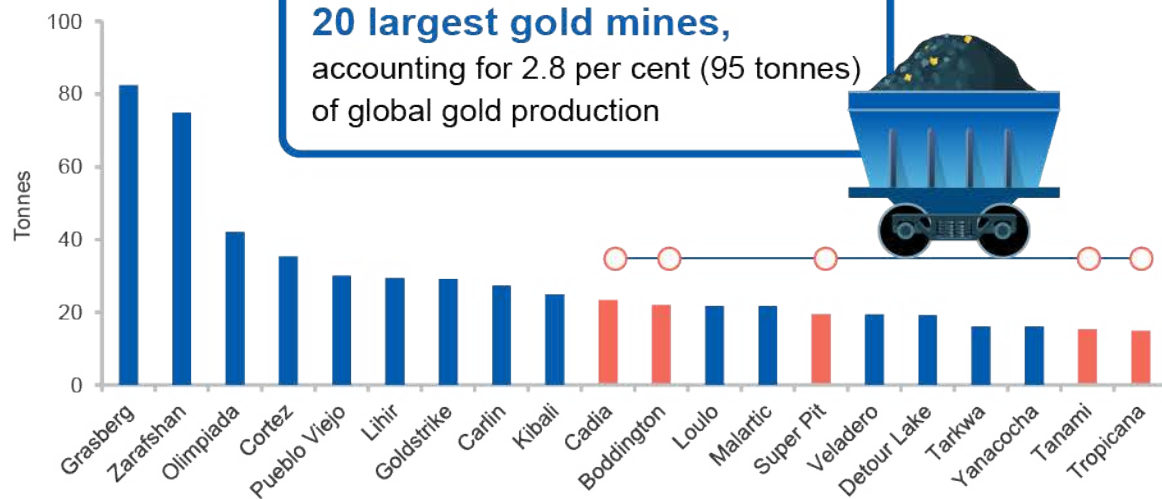


Australia has the **world's largest economic demonstrated resources (EDR) of gold**, with 18 per cent of global EDR

Australia is the world's second largest gold producer



Australia has 5 of the world's **20 largest gold mines**, accounting for 2.8 per cent (95 tonnes) of global gold production



16.1 Summary

Gold is in greater abundance in Australia than any other country in the world. Australia has the world's largest economic demonstrated resources (EDR) of gold, with 18 per cent of global EDR. The Australian gold industry:

- has five of the world's twenty largest gold mines and two of the world's twenty largest gold mining companies;
- is the world's second largest gold producer and the sixth largest gold exporter (exporting \$19 billion in 2018);
- directly employed 22,600 people in 2018.

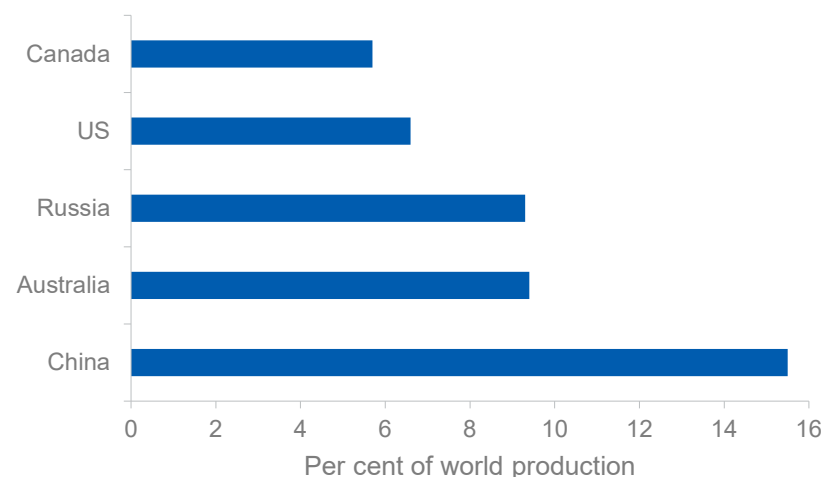
16.2 Mine production

Australia is the world's second largest gold producer, accounting for 9.4 per cent (or 315 tonnes) of global gold mined production in 2018 (Figure 16.1). China produced 518 tonnes of gold in 2018, making it the world's largest gold producer (accounting for 15 per cent of global gold mined production). Russia (9 per cent), the United States (7 per cent) and Canada (6 per cent) make up the next three largest gold mine producers.

The Australian gold industry comprises 71 operating gold projects (some containing multiple individual gold mines) across all Australian states and the Northern Territory. Western Australia leads production, with 68 per cent (or 218 tonnes) of Australian gold production in 2018–19, followed by New South Wales, which accounted for 13 per cent (or 42 tonnes) of Australia's total gold output in 2018–19 (Figure 16.2).

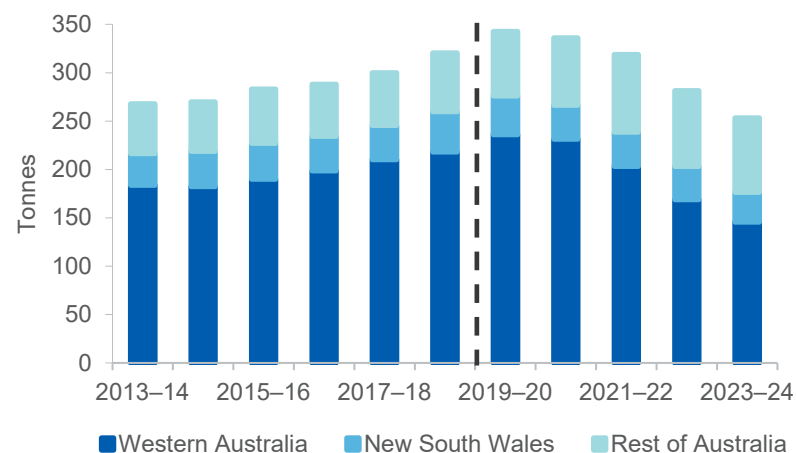
Australia has five of the world's twenty largest gold mines (Figure 16.3). These include the Cadia mine, in 10th position, Boddington (11th), Super Pit (14th), Tanami (19th) and Tropicana (20th). These five gold mines account for 2.8 per cent (or 95 tonnes) of global gold production (Figure 16.3). The Cadia Hill gold mine, located near Orange in New South Wales and owned by Newcrest Mining, is the second largest open-cut mine in Australia after the Super Pit at Kalgoorlie, Western Australia. The operation was merged with Cadia Valley in the December quarter 2010. Over 280 tonnes of gold has been produced from the Cadia Valley operations since commercial

Figure 16.1: World's top 5 gold producers, 2018



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

Figure 16.2: Gold mine production by Australian states and territory



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

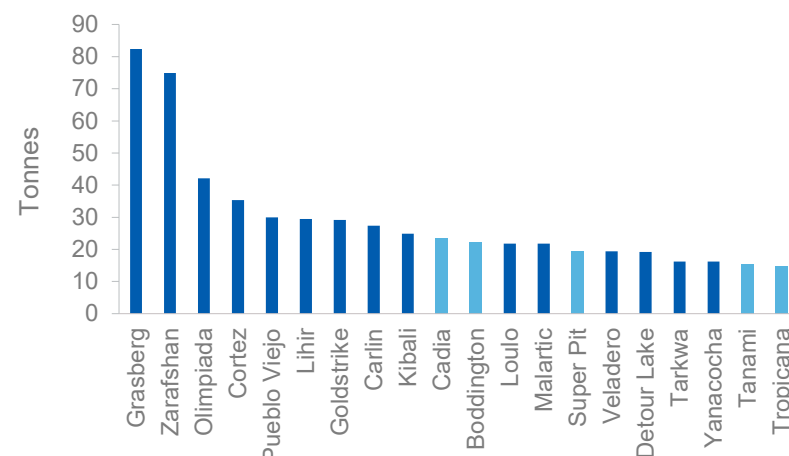
production began in 1999. Production is forecast to rise by 3.3 tonnes a year in 2020, as the mine's expansion project is completed in the second half of 2019. The Boddington gold mine is located 130km southeast of Perth in Western Australia. Gold was discovered in Boddington in 1980. The mine is estimated to contain 364 tonnes of gold reserves and 112 tonnes of gold resources. It produced over 22 tonnes of gold in 2018.

Australia also has two of the world's twenty largest gold mining companies, of which Newcrest Mining is in 10th position and Northern Star Resources is in 20th position (Figure 16.4). These two companies account for 2.9 per cent (or 99 tonnes) of global gold mined production.

Most gold mining companies have adopted the World Gold Council's guidelines for reporting all-in sustaining cost (AISC) of production. Australia's average AISC is US\$742 a troy ounce, which is below the world AISC average of US\$804 a troy ounce (Figure 16.5). Thus Australian gold producers are, on average, more competitive with lower mining, processing, administrative and support costs than gold producers in Canada, US, Brazil and South Africa, but less competitive than those in Russia, China and Mexico. With the price of US\$1,332 an ounce (as of 12 June 2019), healthy margins are being made throughout the Australian sector on a per ounce gold basis.

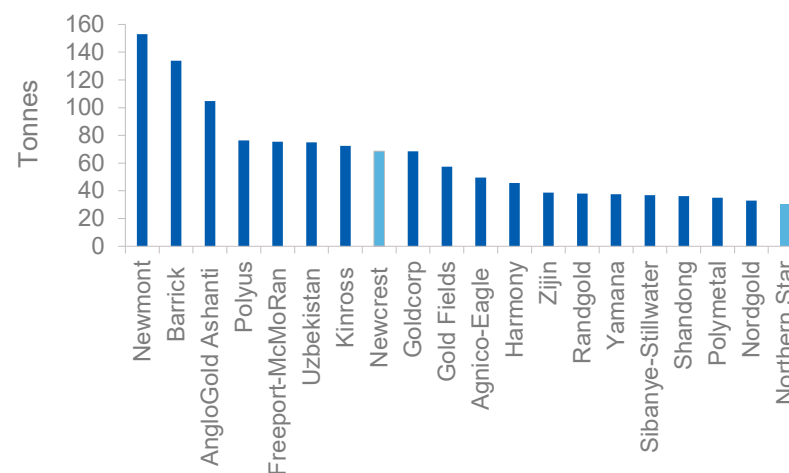
Over the medium to long term, Australia's position as the world's second largest gold producer is expected to be challenged by Russia, as some mature gold mines in Western Australia come to their end of life. Based on 2018 production rates, gold mine capacity likely to close in Australia is projected to be around 153 tonnes between 2019 and 2024 (Figure 16.6). In Russia, gold production is projected to hit a record of 400 tonnes by 2030, as a result of increased exploration and production activity in the eastern Siberia, Magadan and Yakutia regions. China is expected to remain the world's largest gold producer in the medium term. The Chinese Ministry of Industry and Information Technology has implemented plans to lift the country's annual gold output to over 550 tonnes by 2020; such output has the twin objectives of creating/maintaining employment in the industry and helping to raise China's gold reserves.

Figure 16.3: World's top 20 gold mines, 2018



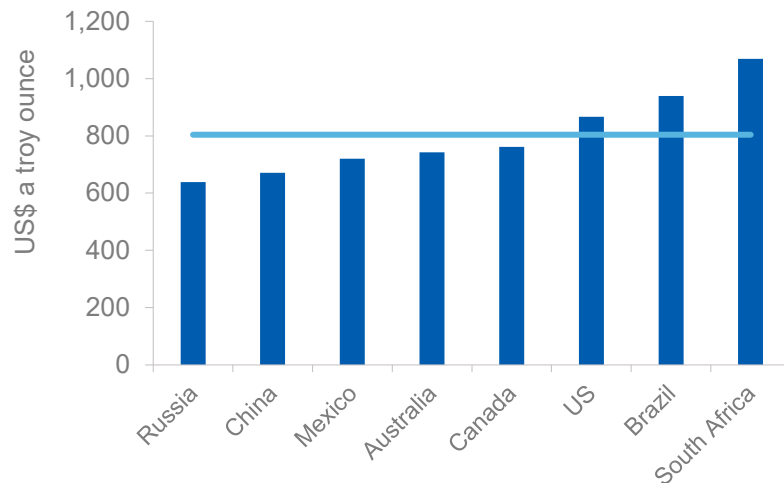
Source: AME (2019); Department of Industry, Innovation and Science (2019)

Figure 16.4: World's top 20 gold mining companies, 2018



Source: AME (2019)

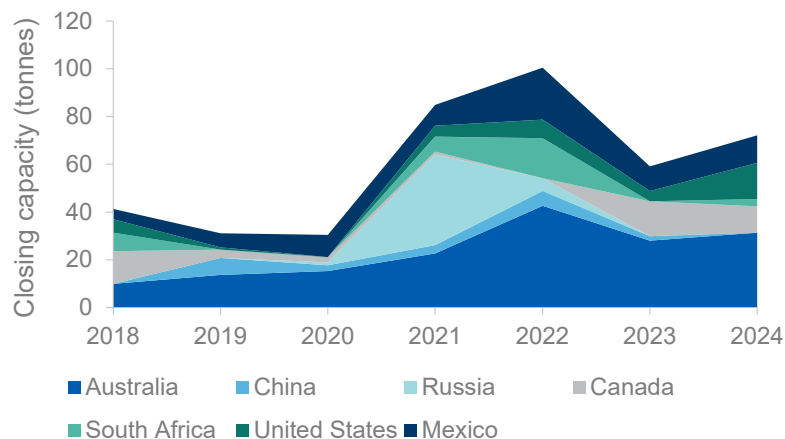
Figure 16.5: Gold production all-in sustaining costs



Notes: Blue line represents the average world all-in sustaining costs

Source: AME (2019)

Figure 16.6: Mine capacity set to be closed, by country



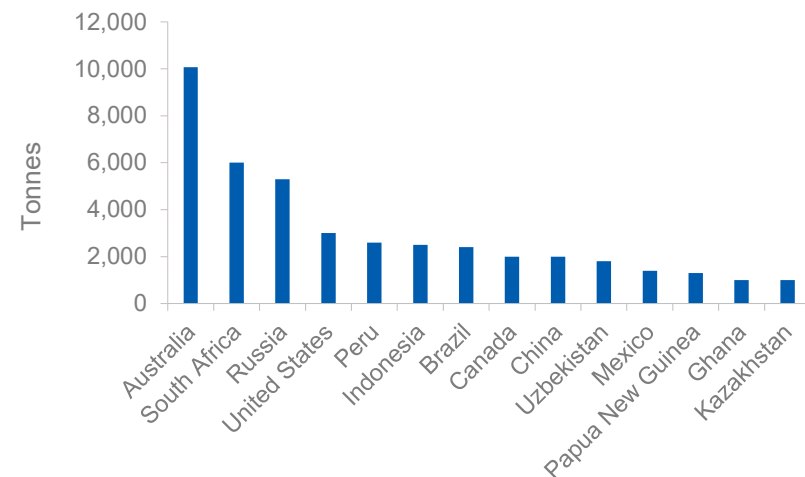
Source: AME (2019)

16.3 Economic demonstrated resources and exploration

The long term future and sustainability of the Australian gold industry is measured by its economic demonstrated resources (EDR) — resources that are established, analytically demonstrated or assumed with reasonable certainty to be profitable for extraction or production. Australian EDR accounts for the largest resource by any country, with 18 per cent of the global total, ahead of South Africa (11 per cent), Russia (10 per cent), the United States (6 per cent), and Peru (5 per cent) (Figure 16.7). At the end of 2017, Australia had an accessible EDR of 10,070 tonnes of gold, of which 38 per cent (or 3,869 tonnes) was classified as ore reserves. Approximately 75 per cent (or 2,903 tonnes) of the gold in ore reserves is attributable to 71 operating gold projects.

However, several gold deposits (estimated to hold around 30 tonnes of gold) are not available for exploration because of legal and land use restrictions. These include the Jabiluka, Koongarra and Coronation Hill mines in the Northern Territory.

Figure 16.7: World economic demonstrated resources of gold

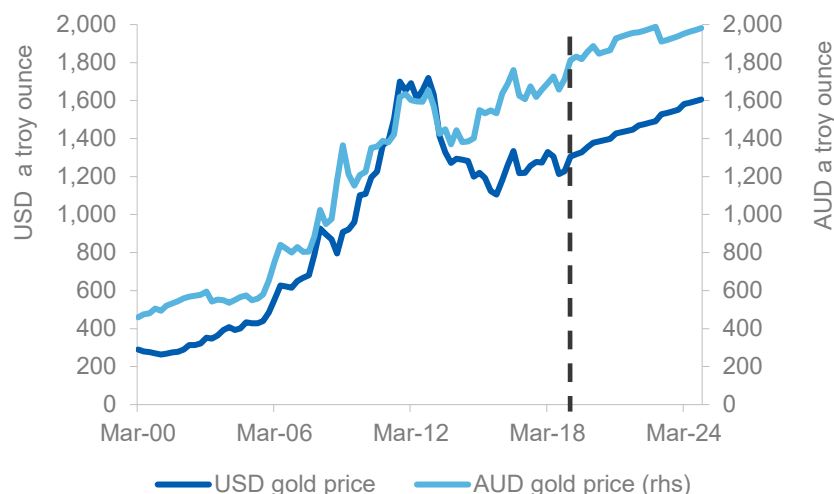


Source: Geoscience Australia (2019); Statista (2019) World mine reserves of gold

At present, the Australian gold industry is enjoying favourable market conditions, with record high Australian dollar gold prices. Both Australian and US dollar gold prices have moved upward over the last few years, and upward movements are forecast — in the March 2019 REQ — to continue throughout the 2019-2024 outlook period (Figure 16.8). The high price has helped to invigorate exploration in the Australian gold sector, as gold producers plan to raise their gold resources. Australia's gold exploration expenditure has increased for four consecutive years, from 2014 to 2018, with growth averaging AUD\$684 million a year.

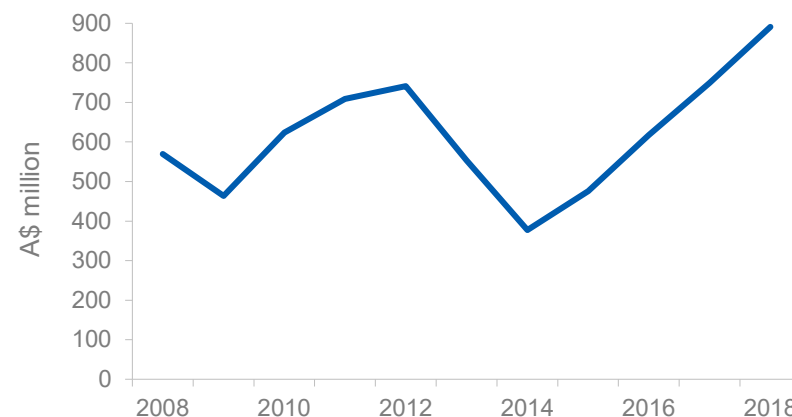
In 2018, gold accounted for 41 per cent of total Australian minerals exploration expenditure, with AUD\$891 million spent on exploration (Figure 16.9). The majority of gold exploration expenditure has been used for upgrading resources around existing deposits, especially on converting inferred resources into higher resource categories.

Figure 16.8: AUD and USD gold prices



Source: London Bullion Market Association (2019); Department of Industry, Innovation and Science (2019)

Figure 16.9: Australia's gold exploration expenditure



Source: ABS (2019) Mineral and Petroleum Exploration

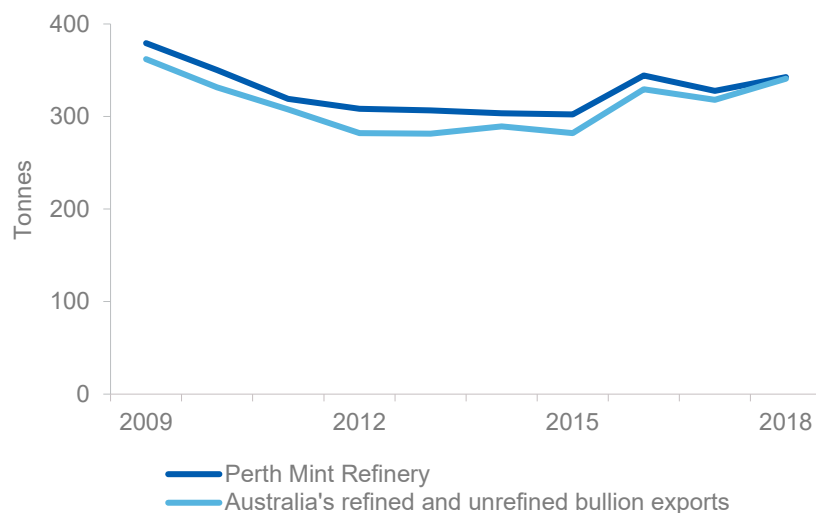
16.4 Refining

Australia is not only a major producer and exporter of gold, it is also a key player in the world gold refining industry. Most gold mined in Australia is refined at Perth Mint Refinery in Western Australia before being exported to the overseas markets. Perth Mint is one of the largest refineries in the world, with an annual refining capacity of over 300 tonnes (Figure 16.10). The refinery is one of a few global gold refiners who have accreditation from the major gold exchanges — the London Bullion Market Association (LBMA), the New York Commodity Exchange (COMEX), the Shanghai Gold Exchange (SGE), the Tokyo Commodity Exchange (TOCOM), and the Dubai Multi Commodities Centre (DMCC).

The Perth Mint distributes over \$18 billion of pure gold, silver and platinum bullion bars and coins to investors in more than 100 countries every year. Through its depository capacity, the Perth Mint also provides the world's sole government precious metals investment and storage program.

ABC Refinery — the exclusive manufacturer of ABC Bullion — is Australia's largest and most technologically advanced independent gold refinery in Australia, and it is accredited by the SGE and LBMA.

Figure 16.10: Perth Mint Refinery and Australia's refined and unrefined bullion exports



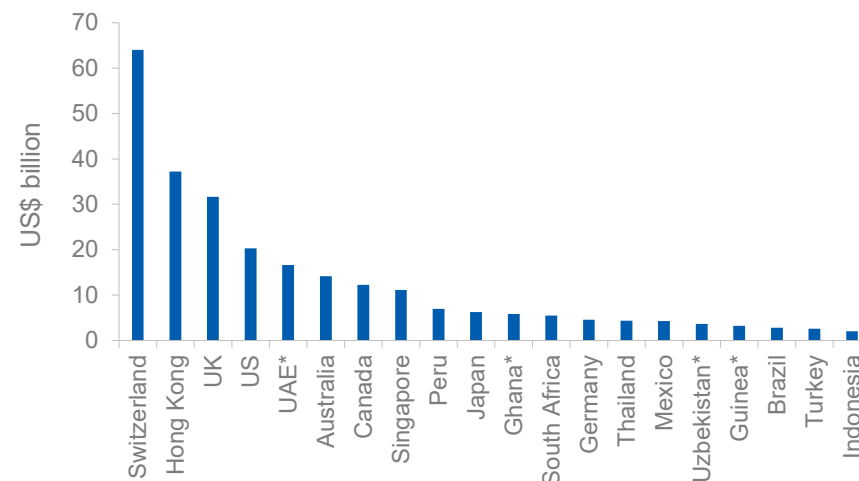
Source: Perth Mint Refinery (2019); Australian Bureau of Statistics (2019)

16.5 Exports, imports and domestic consumption

Australia is the world's sixth largest gold exporter, behind Switzerland, Hong Kong, the United Kingdom, the United States and the United Arab Emirates (Figure 16.11). In 2018, Australia exported 341 tonnes of refined and unrefined gold bullion, with a value totalling USD\$14 billion (AUD\$19 billion). These figures are dominated by re-exports associated with Exchanged Traded Funds and other investment flows.

Demand for Australian gold was largely dominated by Hong Kong and China, who accounted for 37 and 31 per cent, respectively, of Australia's gold exports in 2018. Hong Kong is a fast-growing market for Australian gold, as the Special Administrative Region's close links to China and the recent collaboration between the Shanghai Gold Exchange and the Chinese Gold and Silver Exchange has increased physical gold trading activities. Other important destinations for Australia's gold include the

Figure 16.11: Gold exports by country, 2018



Notes: * 2017 figures

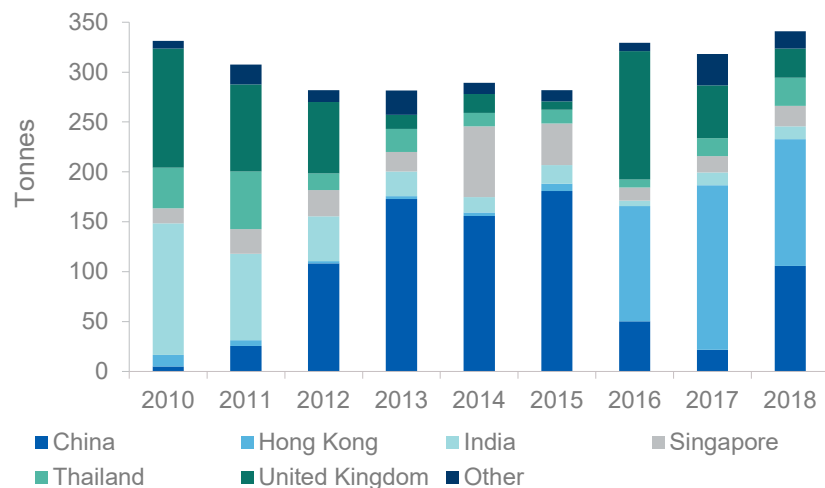
Source: International Trade Centre (2019) Trade Map

United Kingdom — with an 8.5 per cent share of Australia's gold exports — followed by Thailand (8.2 per cent), Singapore (6.2 per cent), and India (3.8 per cent) (Figure 16.12).

About a decade ago, India was Australia's largest gold exporting market, consuming 132 tonnes of Australian gold in 2010. However, gold exports to India have fallen significantly since 2014, at an average 13 tonnes of gold a year — 90 per cent down from the 2010 export level. There are various reasons for this decline, including increased import duties and increased gold refining capacity in India.

Australia imported semi-processed ore containing 112 tonnes of gold in 2018, with a value of AUD\$6.1 billion. Of this, 47 per cent came from Papua New Guinea (PNG), and 9.3 per cent from New Zealand (Figure 16.13). Virtually all gold ores from the Ok Tedi mine in PNG are shipped to the Perth Mint refinery for processing and re-export.

Figure 16.12: Australia's major gold export markets

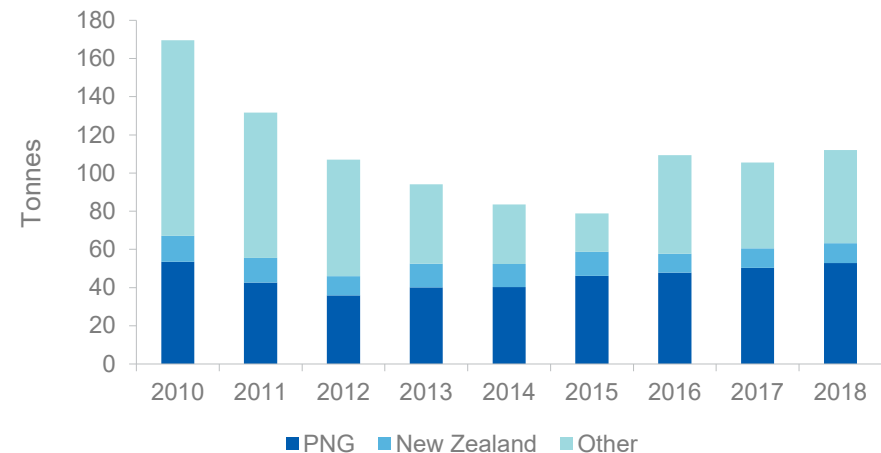


Source: ABS (2019)

Australia's domestic gold market consumed 54 tonnes of refined and unrefined gold bullion in 2018 (Figure 16.14). This is down significantly from levels at the start of the decade. A number of factors explain the decline. In 2010, Australian gold consumption was likely boosted by safe haven demand associated with the Global Financial Crisis. The rise in the Australian dollar price of gold since 2010 is likely to have had an adverse impact on domestic consumption.

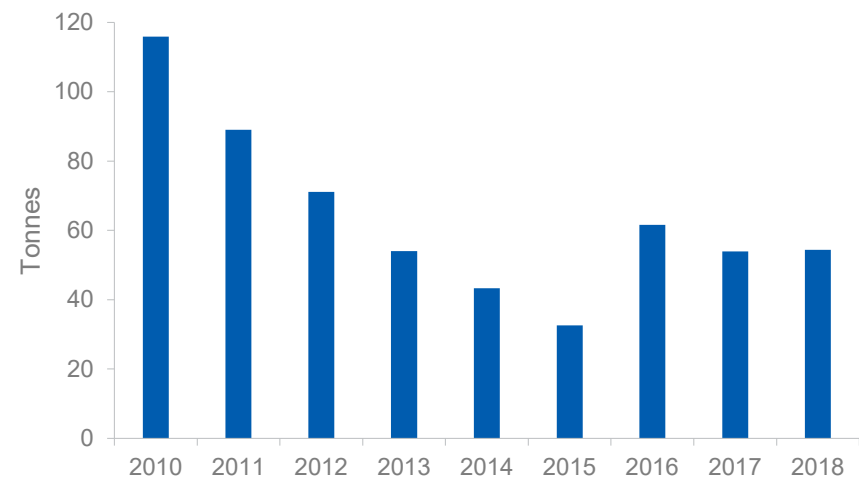
There are 82 gold bullion traders in Australia who provide facilities to buy, vault and trade physical gold bullions. Despite having no bullion market exchange, Perth Mint — as a member of the LBMA — has been considered as something of a proxy for the Australian gold market. It distributes over AUD\$18 billion of pure gold, silver and platinum bullion bars and coins to investors in more than 100 countries every year. Through their depository capacity, it also provides the world's sole government precious metals investment and storage program.

Figure 16.13: Australia's gold imports



Source: Australian Bureau of Statistics (2019); Department of Industry, Innovation and Science (2019)

Figure 16.14: Australia's domestic gold consumption



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

16.6 Opportunities and challenges

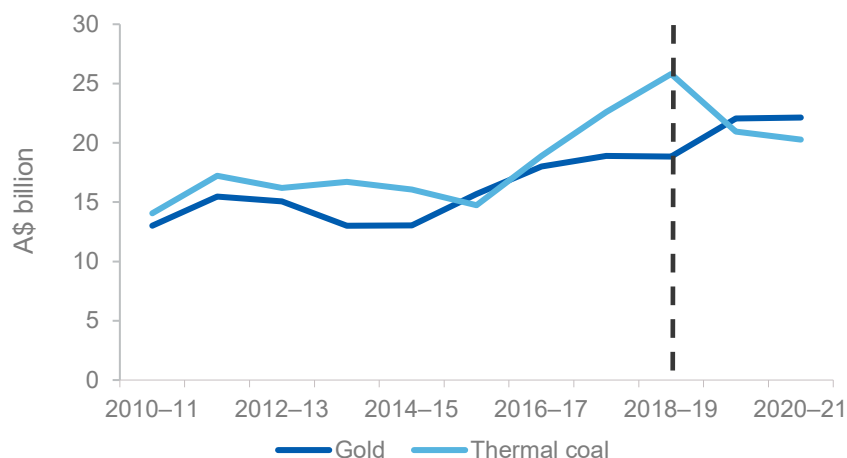
The Australian gold industry is expected to remain strong, with opportunities to export more gold, likely to Asia.

Asian countries consumed 80 per cent of global gold in 2018, of which China accounted for 32 per cent, India (25 per cent), the Middle East (9 per cent), and South East Asia (4 per cent). Hong Kong and China were the two largest export markets for Australian gold in 2018, and are expected to remain the principal markets for Australian gold over the coming years.

Australia's gold exports are forecast to grow over the next few years, to a peak of over \$22 billion in 2020–21 (Figure 15.15). The growth reflects expected rises in local gold production and export volumes to Asia, particularly Hong Kong and China.

If thermal coal is separated from metallurgical coal, gold is forecast to overtake thermal coal as the fourth largest export commodity in 2019–20 and 2020–21 (Figure 16.15), behind iron ore, LNG and metallurgical coal.

Figure 16.15: Gold and thermal coal export values



Source: Australian Bureau of Statistics (2019); Department of Industry, Innovation and Science (2019)

Maintaining Australia's position as the world's second largest gold producer, will require continuous efforts to improve the industry's competitiveness through innovation and enhanced exploration.

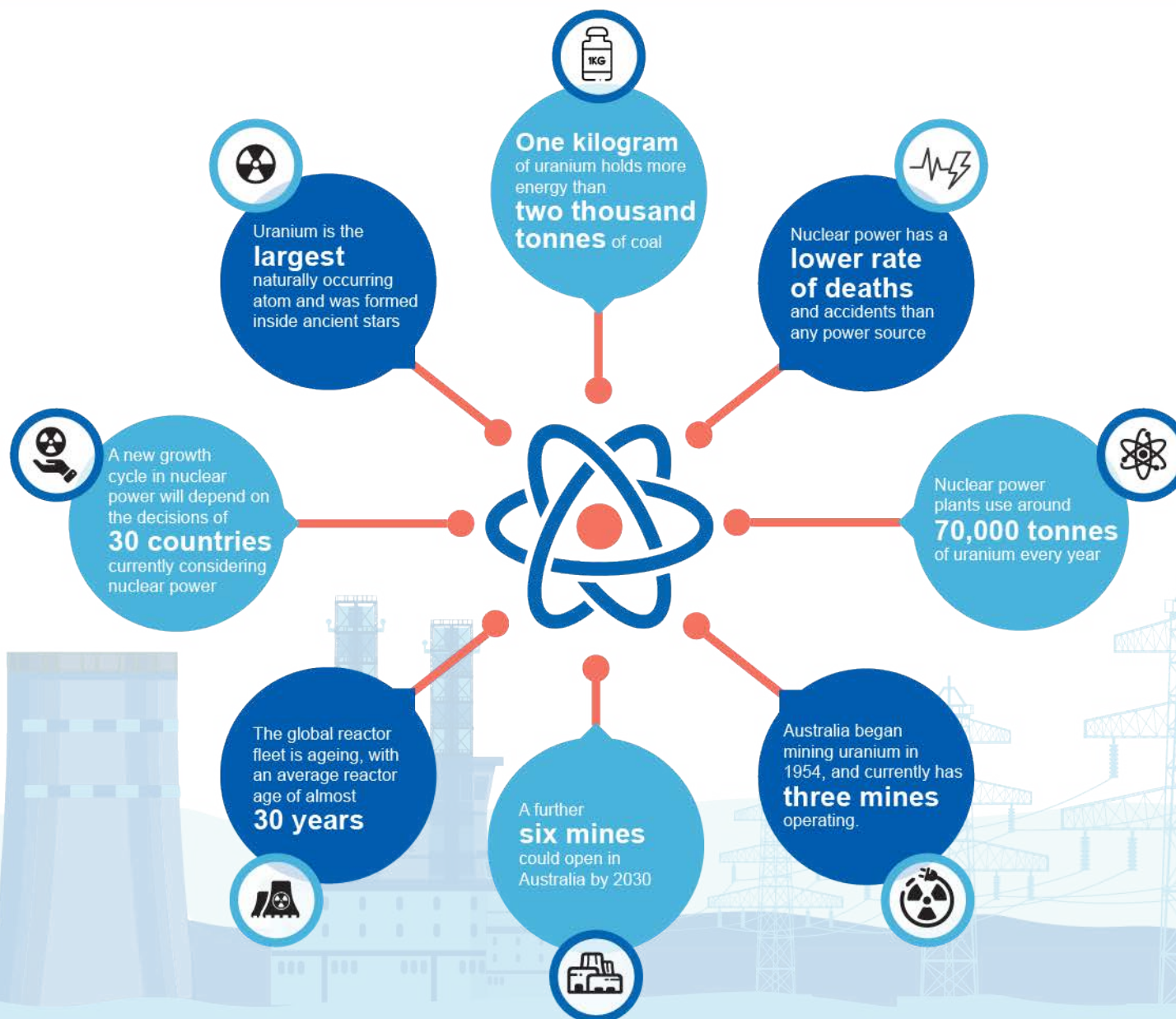
The application of new technology and innovative processes is enabling the industry to discover new resources, improve productivity, protect the environment, and support local communities. The innovation partnerships such as CRC Ore (www.crcore.org.au) and Mining3 (www.mining3.com), and collaboration with higher education institutions are examples of partnerships that address the challenge of extracting gold from lower grade ore and developing ways of separating gold from extracted materials. Innovation is also a means to overcome Australia's depleted gold resources — the running down of resource deposits.

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. The decline in exploration success is largely due to the difficulty of exploring beneath post-mineralisation sedimentary basins. Australia is still under-explored, and future success is dependent on the expansion of the research and discovery to those areas that are under cover. The UNCOVER Australia (www.uncoveraustralia.org.au) — an initiative that brings together geoscience researchers in industry, governments and academia, to explore and uncover Australia's hidden mineral wealth — has the potential to address the challenges that the Australian gold industry is facing.

Access to more geological data is important to the sustainability of Australia's gold industry. The AEM survey (the world's first innovation and largest airborne electromagnetic survey) uses aircraft-mounted equipment to map the degree of electrical conductivity below the earth's surface to a depth of several hundred metres. Geoscience Australia has completed the AME survey for the Northern Territory and Queensland, and conducted an AME survey for Western Australia. When completed, both surveys will cover more than one million square kilometres — an area larger than France and Germany combined — to help identify potential new mineral deposits (www.ga.gov.au/efft).

Nuclear power and uranium markets

Resources and Energy Quarterly June 2019



17.1 Summary

- The uranium market is emerging from a sharp downturn after Fukushima, with capital starting to flow towards nuclear power again.
- Long term prospects will depend on a range of factors, including climate change pressures, technological progress, and the decisions of around 30 countries that are considering nuclear energy programs.

17.2 The arc of nuclear power

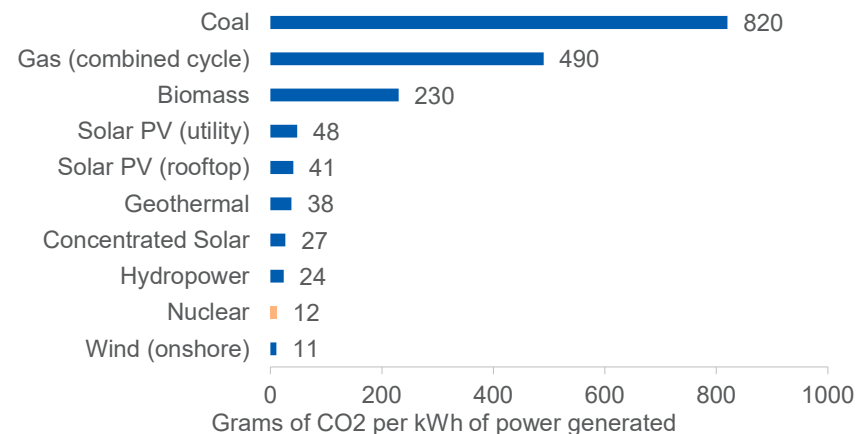
Virtually all uranium is mined for a single purpose — to fuel nuclear power plants. Power is generated in these plants by striking uranium nuclei with neutrons. The resulting reaction splits the uranium nuclei and releases energy. The reaction also releases additional neutrons, which strike further nuclei, creating a chain reaction and a progressive release of power. Uranium is almost unique in its capacity to generate this chain reaction. Outside of the reactors, nuclear plants are similar to coal plants: energy generates steam, which spins a turbine and powers a generator.

Interest in nuclear power is growing at present. This is partly because nuclear power is extremely low-carbon emitting compared with other energy sources (Figure 17.1). Nuclear generation is also reliable and scalable, and requires minimal use of land and materials. As electrification increases power demand, the International Energy Agency has estimated that nuclear generation will need to double its output over the next 30 years in order to hold global temperature warming below 2 degrees.

Nuclear power also has the lowest loss of life and best safety record of any form of power generation (Figure 17.2). While all forms of power generation have been associated with accidents (for example, gas plants to explosions, hydro-electric power to dam failures, coal and oil to spills and pollution), nuclear accidents have been exceedingly rare. Only one accident (Chernobyl) has directly caused loss of life, and no fatal accidents have ever occurred in a modern reactor.

Australia, with three mines in operation and six more in prospect, could play a crucial role as a uranium supplier. However, the prospects for uranium miners are inherently linked to the future of nuclear power.

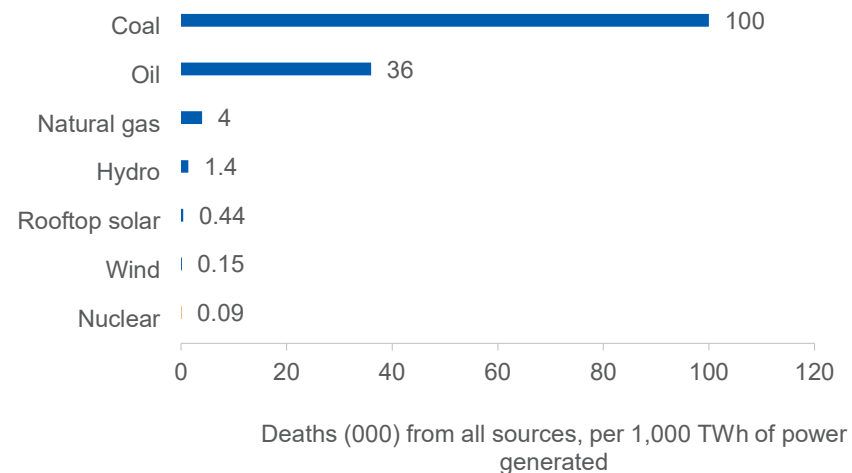
Figure 17.1: Carbon emissions by power source



Note Lifecycle emissions.

Source: IPCC (2019) Working Group III—Mitigation of Climate Change, Annex III

Figure 17.2: Safety record by power source



Source: Cambridge House (2019), 'The World's Safest Source of Energy Will Surprise You', Desjardins (2019)

Nuclear power hit its stride in the 1970s and 1980s, before tailing off

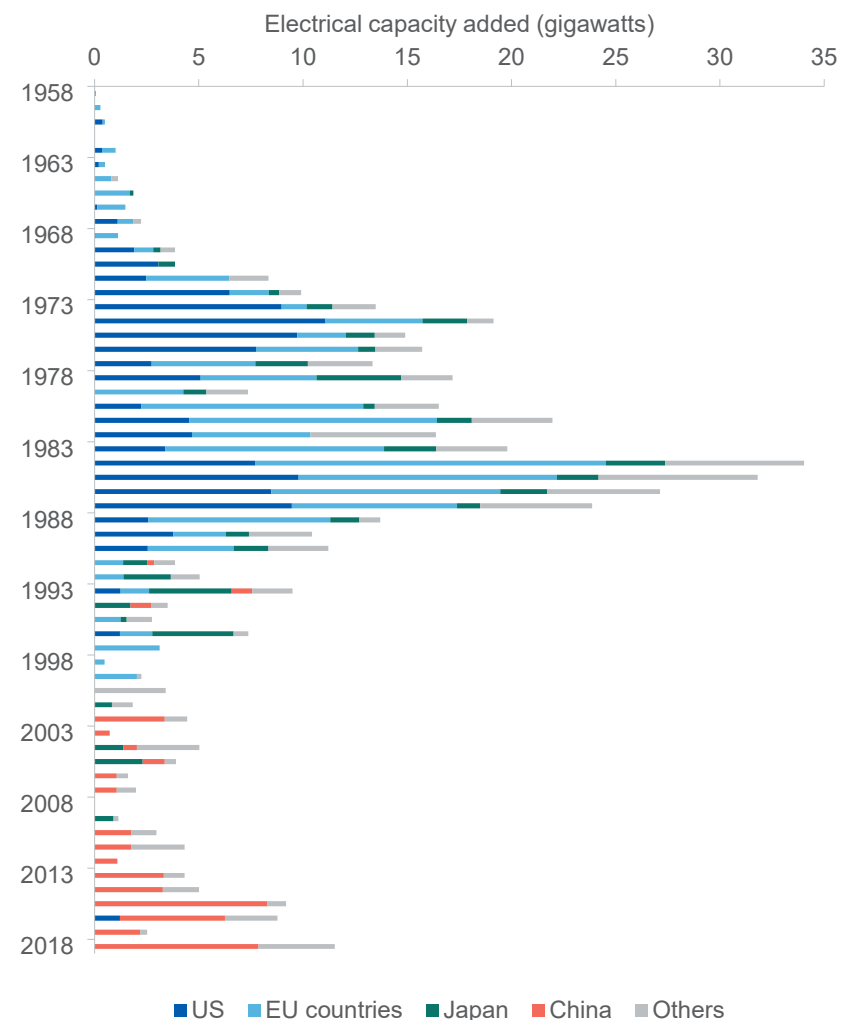
Nuclear research in the modern age was advanced by physicists such as Ernest Rutherford, Albert Einstein, and Niels Bohr, who made crucial discoveries in the 1930s. The first nuclear reactor was built in the US in 1942, and nuclear energy was used to generate electricity for the first time in 1951. The USSR began feeding its power grid with nuclear power in 1954. The first commercial plant was opened in England in 1956, and the US opened its first commercial plant a year later. Rapid growth in nuclear power followed, as Figure 17.3 shows.

By 1960, global nuclear deployment was lifting towards 1 gigawatt (GW). Public opposition to nuclear power was present in many countries from the earliest days of nuclear power generation, and the industry has always faced significant regulatory risks, which have often affected the availability of capital and led to rising costs and construction delays. However, the 1973 oil crisis proved to be a decisive event, with France and Japan leading a wave of investment in nuclear power as countries sought to break their dependency on oil. Investments from the US and Europe led to an average of 20 reactor constructions every year during the 1980s.

However, investment in nuclear power gradually receded towards the end of the decade. This was partly a result of regulatory changes, which increased the commencement period for reactor constructions (the time between initiation and construction) in the US from around 16 months (in the late 1960s) to 54 months by 1980. This, in conjunction with rising litigation and public opposition, added to the cost and financial risks associated with reactor development and construction.

This downturn led in turn to a loss of skills in the nuclear construction sector, which left it increasingly unable to meet the more exacting standards required for reactor constructions. Nuclear reactor construction had entered a downward spiral by the early 2000s, with mining firms exiting the market rapidly. When recovery came, China was the crucial driving factor.

Figure 17.3: Global reactor constructions



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

Nuclear energy growth is starting to diversify beyond China

China's nuclear power rollout was very rapid, with the country focusing strongly on attaining economies of scale. As Figures 17.3 and 17.4 show, China has come to dominate global nuclear reactor constructions.

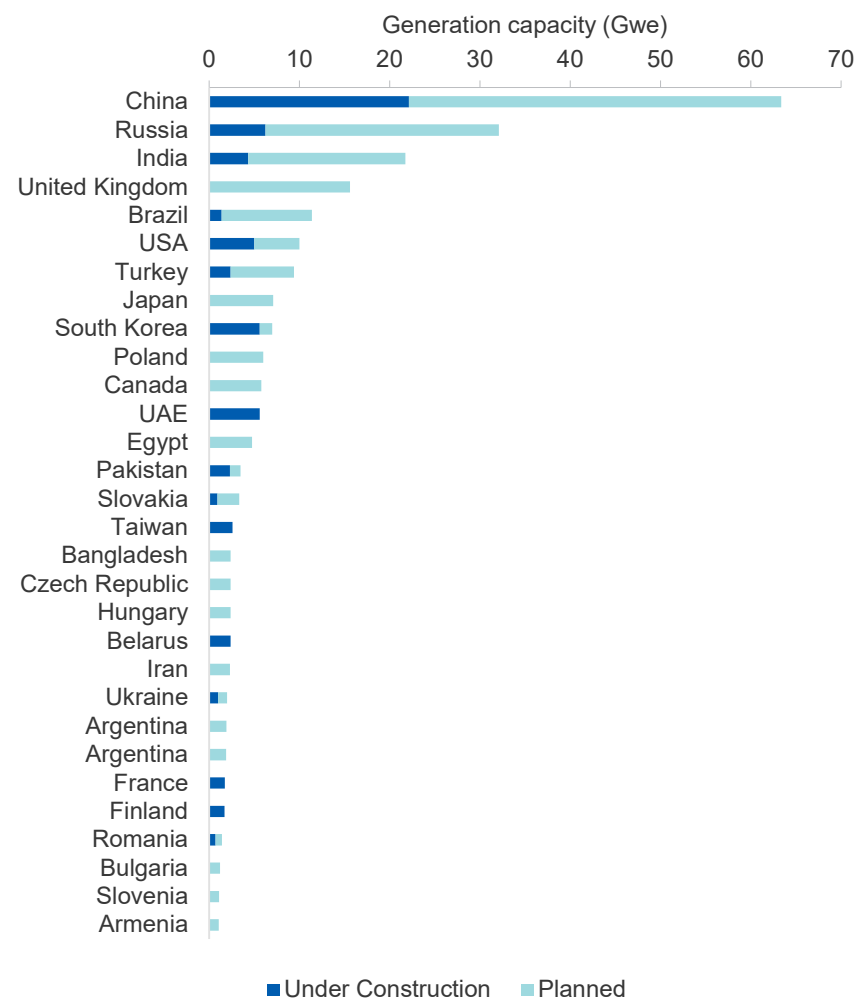
China's construction rate has slowed in recent years, but its large investments have led to improved technology and expertise, enabling take-up of the technology in other countries. A number of these countries have now begun to plan future constructions. The pipeline for reactors in the planning stage is thus far more diverse than that for reactors currently under construction (Figure 17.4). As a result, growth in the uranium market will likely be less China-centred in the future, replicating the more diverse market conditions of the 1970s and 1980s.

Reactors are expected to be connected in South Korea, Belarus, Russia, Finland, the United Arab Emirates, India, Slovakia, and Argentina by 2022. Constructions are also progressing in Turkey, Abu Dhabi and Bangladesh, with a further 25 countries considering, planning, or progressing programs. China is building a large export industry, and Russia's Rosatom expects to double its annual export revenue to US\$15 billion by 2024.

This growth may come up against uranium supply issues in the near future. The post-Fukushima fall in uranium prices led a number of uranium mines being deferred or placed in care and maintenance. A return to operation for these projects will take time, due to the scale of regulation around uranium supply. This could result in a price and supply crunch by the mid-2020s. However, as uranium prices are a tiny share of power generation costs, the main impact is likely to be a windfall for producers.

Over the longer term, much will depend on whether the large potential volume of reactors in planning stages ultimately come to fruition. Should construction proceed on schedule, nuclear energy would lift from around 10 per cent of total electricity supply to 13 per cent by 2030. However, decisions to extend or shut down existing reactors will also play a role, since most reactors are now more than 30 years into an approximate 60-year lifespan. Further out still, prospects will depend on how many of the 25 countries currently considering the technology end up adopting it.

Figure 17.4: Global reactor construction pipeline



Source: World Nuclear Association (2019); Department of Industry, Innovation and Science (2019)

17.3 The outlook for nuclear power

Success of nuclear power rollouts depends on following best practice

Deployment of nuclear power has met with mixed results. Successes include France, which replaced its entire coal grid with nuclear power in around 15 years (concluding in 1992), and Sweden, which rolled out a large nuclear grid in around 20 years (concluding in 1985). More recently, China has also built 25 reactors over the past 5 years.

Yet, countries such as the US and UK — which have rolled out nuclear reactors successfully in the past — are currently struggling, with nuclear construction in these countries facing long delays and cost overruns.

Performance and cost competitiveness of nuclear power also varies between countries, with regulation playing a crucial role. In both China and South Korea, companies can build reactors at less than one-fifth of the cost to construct in the US. In South Korea and France, nuclear power remains by far the cheapest energy source, easily undercutting gas, renewables, and coal. In contrast, reactors in the US face closure risks due to their lack of competitiveness against gas and renewables.

It is difficult to predict which path countries commencing nuclear power programs follow. However, two factors will likely be pivotal:

- Scale and standardisation — all successful rollouts have involved a small number of reactor designs and a large order book. This allows for economies of scale, repetition, specialisation, and a robust knowledge base to be built. Countries facing cost blow-outs and delays have generally built reactors in low numbers and in a multiplicity of different designs.
- Public support — this has typically lifted sharply in the wake of crises such as the oil price surges of the 1970s, but varies widely between countries. Low public support and political controversy tend to lead to regulatory uncertainty and high risk.

The United Arab Emirates (UAE) is an example of a successful adoption, being on track to construct 6 gigawatt hours of generation in around 10

years, despite having no significant record of nuclear generation in the past. The UAE accelerated its process by hiring experienced offshore companies to build its reactors. Public support for nuclear power in the country is currently above 80 per cent.

In contrast, Vietnam has abandoned its construction plans citing falling demand and rising costs. Other countries remain in the exploratory stage, with potential to go in either direction. But rising electrification, carbon constraints, the need to construct new power grids in Africa and Asia, and the likely need to desalinate large amounts of water, all represent potential upsides for nuclear power generation.

Innovation in nuclear power has sometimes been stymied by regulation, notably in the US, where new reactor models are obliged to follow steps designed for much older builds. Rapid construction, such as that in China, has thus been an important technological driver, with several new reactor models being pioneered in the country. This progress improves the prospects for reactor rollouts in other countries in the future.

Technology under development now includes the so-called ‘Generation IV’ reactors. These reactors can combine liquid fuel with fluoride or salt, creating a mixture which acts as both fuel and coolant. This means reactors cannot melt down due to a loss of coolant, and require much less heat and pressure, allowing them to be small enough to transport on trucks. They can be assembled on production lines, inherently harnessing the benefits of scale and repetition which have been pivotal to successful reactor constructions in the past.

Dozens of potential models for such reactors are under development by an array of start-up companies in the US and other countries. More than 30 advanced reactor development projects have been launched since the 1990s, and more than \$2 billion has been committed to their development around the world. The Chinese Government has identified small, molten-salt reactors as a development priority, with plans underway to start up a prototype device within two years. The US Congress recently passed the bipartisan Nuclear Energy Innovation and Modernization Act, which seeks to modernise regulations and foster Generation IV technology.

Nuclear power is expected by most forecasters to continue supplying around 10 per cent of global energy. Under these assumptions, growth in China, India, the UAE, and other Asian countries will offset reactor closures in the US and Germany.

However, most risks to forecasts are now on the upside. Nuclear generation faced a prolonged depression after Fukushima, and further sharp falls at this point in the cycle are unlikely. But there are many potential drivers — economic and technological — which could stimulate a new wave of reactor builds. The competing priorities many countries face — seeking both to constrain carbon emissions and rapidly expand their power output — may lead to a return of the political and economic imperatives of the 1970s, when the oil crisis created a tipping point for widespread growth in nuclear energy. Successful rollouts in countries such as China and the UAE offer a model and a pathway for new entrants.

Re-use and recycling could marginally reduce the need for mined uranium

When uranium nuclei are split, energy is released along with helium and neutron particles. These particles continue to emit from spent fuel even after it has been depleted as a power source. The process by which these particles radiate outward from their source is known as radiation, and the speed and force at which they are emitted means they can cause damage to surrounding material and to living cells.

Spent nuclear fuel represents a tiny volume of waste, and one which can be stored safely in dry casks. Most fission products dissipate in around three hundred years, leaving spent fuel generally no more dangerous than untouched uranium ore of the kind which already exists in substantial quantities underground.

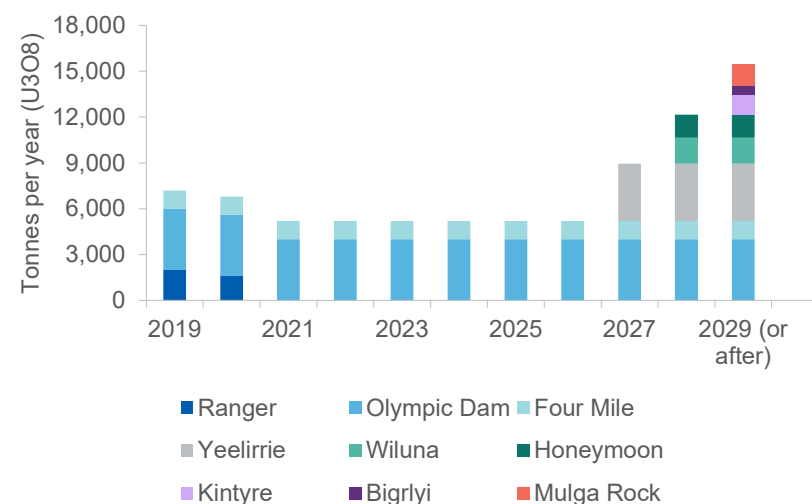
Typically, spent fuel is re-processed to reduce its volume and separate useful material. Breeder reactors — which were first developed in the 1950s — can also re-use spent fuel as a power source. However, it is not likely that recycling and reuse will become widespread enough to wholly displace uranium mining. Mining will thus remain important for electricity generation, medical isotope production and research purposes for the foreseeable future.

Australian supply has potential to grow in scale and importance

Australia currently has three uranium mines: Ranger, in the Northern Territory, Olympic Dam in South Australia, and the Four Mile mine in South Australia. Ranger, which is owned by Energy Resources Australia, is subject to a limited lease, and is required to close in 2020. However, Four Mile has significant deposits remaining and Olympic Dam — one of the world's richest deposits — has enough supply to last for centuries.

Australia also has a further half-dozen mines under development (Figure 17.5), with most located in Western Australia. The post-Fukushima collapse in the uranium price has pushed final decisions on prospective mines further into the future, and it is not clear that all Australian mines under consideration will ultimately commence. However, most of the crucial reviews and permissions have been received, and as the price of uranium edges up, producers are starting to look again at the future of nuclear power around the world.

Figure 17.5: Potential growth in Australian uranium output

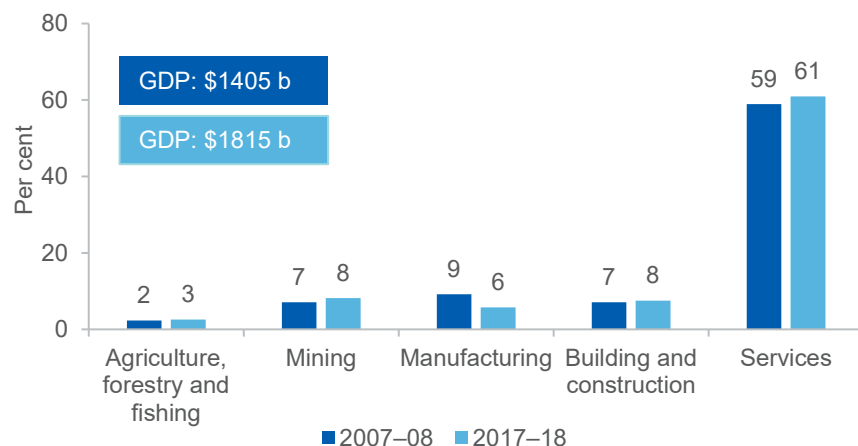


Source: Department of Industry, Innovation and Science (2019)



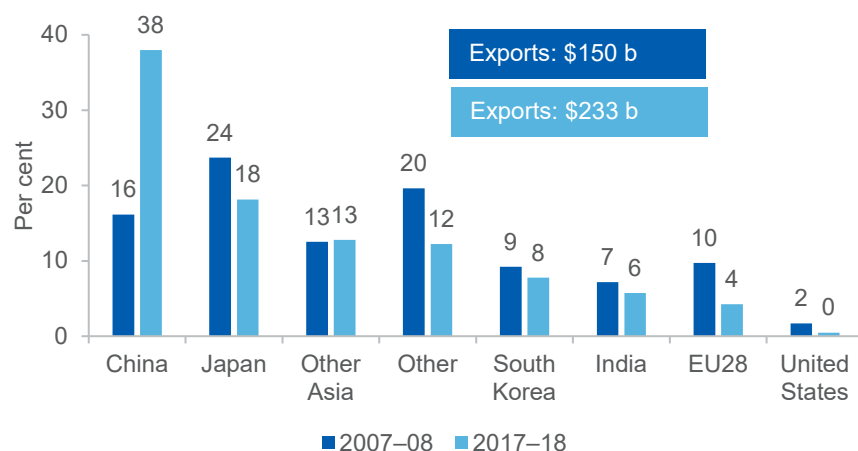
Trade summary charts and tables

Figure 18.1: Industry shares of GDP



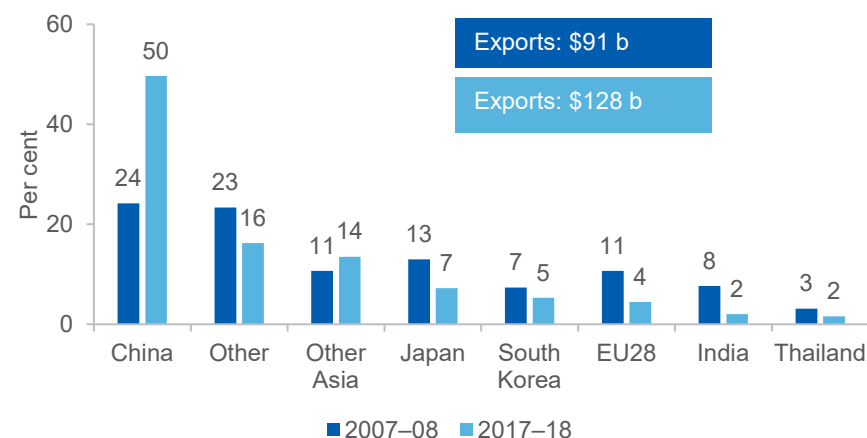
Source: ABS (2019) Australian National Accounts, National Income, Expenditure & Production, 5204.0

Figure 18.2: Principal markets for Australia's resources and energy exports, 2018-19 dollars



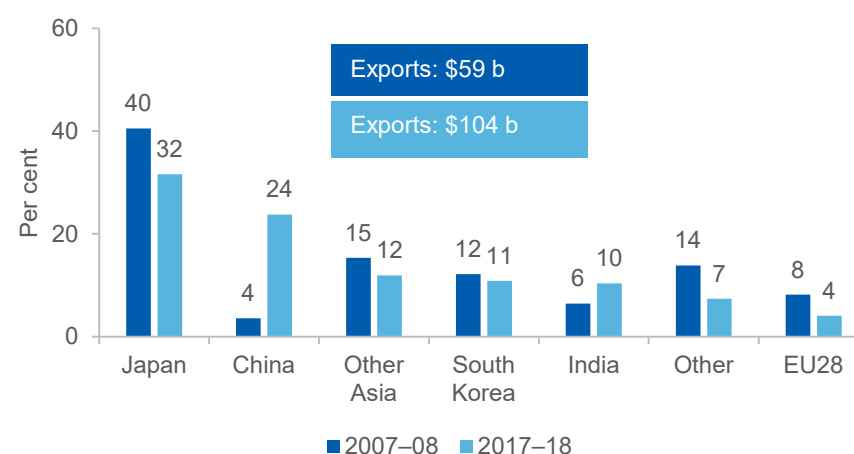
Source: ABS (2019) International Trade in Goods and Services, 5368.0

Figure 18.3: Principal markets for Australia's resources exports, 2018-19 dollars



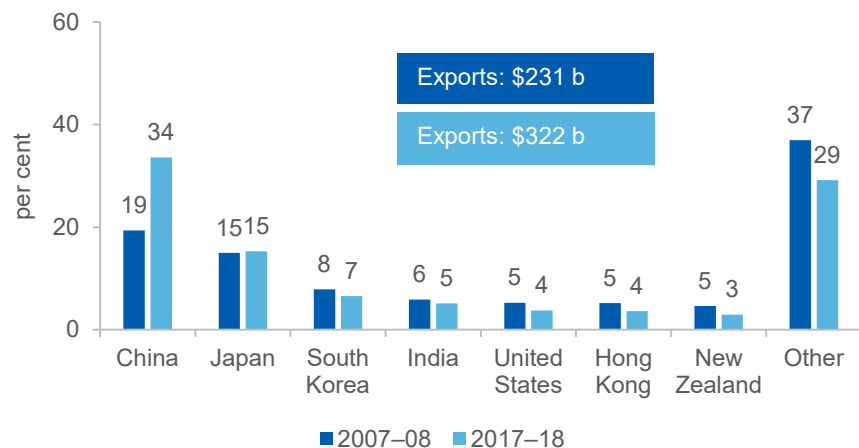
Source: ABS (2019) International Trade in Goods and Services, 5368.0

Figure 18.4: Principal markets for Australia's energy exports, 2018-19 dollars



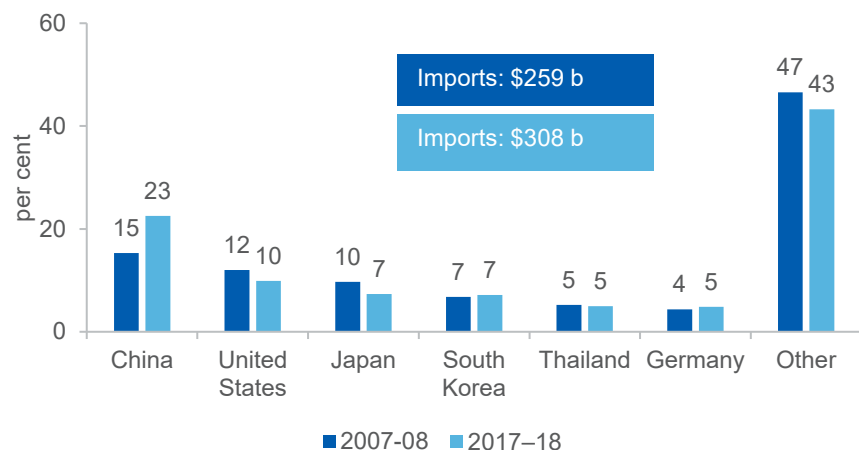
Source: ABS (2019) International Trade in Goods and Services, 5368.0

Figure 18.5: Principal markets for Australia's total exports, 2018–19 dollars



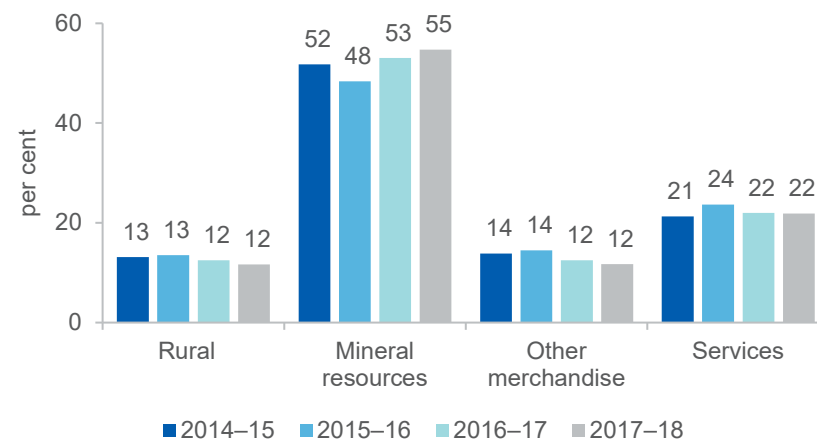
Source: ABS (2019) International Trade in Goods and Services, 5368.0

Figure 18.6: Australia's total imports by country of origin, 2018–19 dollars



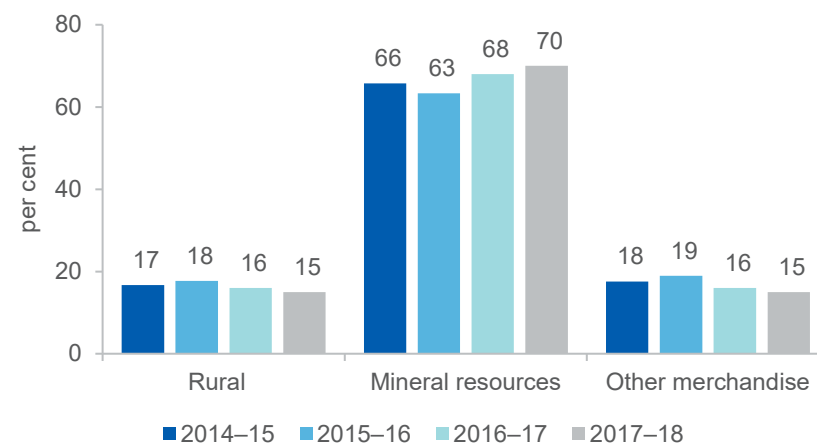
Source: ABS (2019) International Trade in Goods and Services, 5368.0

Figure 18.7: Proportion of goods and services exports by sector



Source: ABS (2019) Balance of Payments and International Investment Position, 5302.0

Figure 18.8: Proportion of merchandise exports by sector



Source: ABS (2019) Balance of Payments and International Investment Position, 5302.0

Table 18.1: Principal markets for Australia's thermal coal exports, 2018–19 dollars

	Unit	2013–14	2014–15	2015–16	2016–17	2017–18
Japan	\$m	8,363	7,611	7,234	8,561	10,033
China	\$m	3,767	2,934	1,832	3,646	4,832
South Korea	\$m	3,008	2,861	2,667	2,665	3,031
Taiwan	\$m	1,801	1,895	1,666	2,349	2,622
Malaysia	\$m	376	626	519	669	762
Thailand	\$m	314	292	332	302	378
Total	\$m	18,214	17,226	15,597	19,650	23,036

Source: ABS (2019) International Trade in Goods and Services, 5368.0

Table 18.2: Principal markets for Australia's metallurgical coal exports, 2018–19 dollars

	Unit	2013–14	2014–15	2015–16	2016–17	2017–18
India	\$m	5,245	5,377	4,877	8,701	9,671
China	\$m	6,386	5,117	4,097	7,957	8,544
Japan	\$m	5,997	4,946	4,611	7,214	7,409
South Korea	\$m	2,680	2,552	2,207	3,835	3,741
Taiwan	\$m	1,270	1,222	1,027	1,894	1,972
Netherlands	\$m	1,094	892	967	1,961	1,827
Total	\$m	25,355	23,383	20,925	36,734	38,546

Source: ABS (2019) International Trade in Goods and Services, 5368.0

Table 18.3: Principal markets for Australia's crude oil and refinery feedstocks exports, 2018–19 dollars

	Unit	2013–14	2014–15	2015–16	2016–17	2017–18
Indonesia	\$m	337	36	374	954	1,334
Singapore	\$m	2,154	1,950	666	1,053	1,197
Thailand	\$m	1,781	1,352	734	586	1,176
South Korea	\$m	694	1	475	467	705
China	\$m	5	29	745	735	643
Malaysia	\$m	320	4	153	444	597
Total	\$m	12,119	9,279	5,757	5,692	7,097

Source: ABS (2019) International Trade in Goods and Services, 5368.0

Table 18.4: Principal markets for Australia's LNG exports, 2018–19 dollars

	Unit	2013–14	2014–15	2015–16	2016–17	2017–18
Japan	\$m	16,415	15,346	11,136	11,760	14,719
China	\$m	695	1,401	3,108	5,930	10,585
South Korea	\$m	478	1,019	1,775	2,656	3,746
Singapore	\$m	0	151	420	1,487	965
Taiwan	\$m	189	43	169	264	706
India	\$m	0	0	533	639	531
Total	\$m	17,778	18,111	17,526	23,191	31,523

Notes: Department of Industry, Innovation and Science estimates based on International Trade Centre data, except for 2016–17 where ABS trade data is available.

Source: ABS (2019) International Trade in Goods and Services, 5368.0; International Trade Centre (2019) International Trade Statistics 2001–2018

Table 18.5: Principal markets for Australia's iron ore exports, 2018–19 dollars

	Unit	2013–14	2014–15	2015–16	2016–17	2017–18
China	\$m	62,181	45,133	41,000	53,578	51,117
Japan	\$m	10,537	7,178	4,951	5,600	5,438
South Korea	\$m	6,648	4,338	3,228	4,063	3,678
Taiwan	\$m	1,864	1,391	1,080	1,489	1,259
India	\$m	45	117	7	5	306
Indonesia	\$m	45	30	57	45	45
Total	\$m	81,416	58,442	50,541	65,097	62,616

Source: ABS (2019) International Trade in Goods and Services, 5368.0

Table 18.6: Principal markets for Australia's aluminium exports, 2018–19 dollars

	Unit	2013–14	2014–15	2015–16	2016–17	2017–18
Japan	\$m	1,215	1,562	737	969	1,401
South Korea	\$m	743	824	1,179	770	861
Thailand	\$m	331	307	284	319	382
Taiwan	\$m	484	524	315	215	334
Indonesia	\$m	213	147	100	158	186
China	\$m	254	54	99	53	34
Total	\$m	3,896	4,168	3,474	3,292	4,093

Source: ABS (2019) International Trade in Goods and Services, 5368.0

Table 18.7: Principal markets for Australia's copper exports, 2018–19 dollars

	Unit	2013–14	2014–15	2015–16	2016–17	2017–18
China	\$m	4,294	3,908	3,792	2,805	3,842
Japan	\$m	1,771	2,133	1,510	1,410	1,556
Malaysia	\$m	666	565	653	894	888
India	\$m	1,030	861	542	710	854
South Korea	\$m	637	392	518	464	296
Philippines	\$m	311	269	232	413	170
Total	\$m	9,493	9,078	8,576	7,868	8,619

Source: ABS (2018) International Trade in Goods and Services, 5368.0

Table 18.8: Principal markets for Australia's gold exports, 2018–19 dollars

	Unit	2013–14	2014–15	2015–16	2016–17	2017–18
Hong Kong	\$m	165	203	2,669	9,992	8,202
United Kingdom	\$m	698	625	4,165	4,068	3,334
China	\$m	8,814	7,454	6,922	2,411	2,997
Singapore	\$m	2,478	3,338	1,264	314	1,180
Thailand	\$m	485	962	268	553	1,165
Switzerland	\$m	376	16	91	234	797
Total	\$m	14,185	13,987	16,587	18,726	19,264

Source: ABS (2018) International Trade in Goods and Services, 5368.0



Appendix

Appendix A

Definitions and classifications

A.1 Exchange rates

In this report, the AUD/USD exchange rate (Australian dollar relative to the US dollars) is based on the median of economic forecasters at the time that the report is prepared. The source is the Bloomberg survey of economic forecasters.

World commodity prices are typically denominated in US dollars, and exchange rate movements can have a significant effect on the actual outcomes of commodity prices and export earnings. A change in the value of the US dollar against other floating international currencies can influence movements in world resources and energy prices. A change in the Australian dollar against the US dollar will impact on export earnings for domestic commodity exporters and producers. There is substantial uncertainty surrounding any exchange rate forecast, with changes to exchange rates influenced by changes in financial market sentiment, sometimes resulting in strong volatility.

A.2 Conversion to real dollars

Nominal values and prices are converted to real dollars using on the Australian and US consumer price indexes (CPI). The Australian and US CPI forecasts are based on the median of economic forecasters at the time that the report was prepared. The source is the Bloomberg survey of economic forecasters.

A.3 Time horizons

It is important to distinguish between different time horizons, as factors affecting production, consumption and prices in the short-term differ from factors affecting these components in the medium to long-term. Forecasts also become increasingly imprecise over longer time horizons, due to increased risk and uncertainty. For these reasons, the OCE uses different terminology to distinguish between short-term forecasts and medium to long-term projections, as outlined in *Table A2*.

Table A1: OCE terminology for time horizons

Outlook period	Years	Terminology
Current period	Current (Incomplete data or subject to revision)	Estimate
Short-term	1 to 2 years	Forecast
Medium-term	3 to 5 years	Projection

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

A.4 Commodity classifications

The Office of the Chief Economist (OCE) defines exports for each commodity 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 with 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 A3*. 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.

Table A2: 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, lithium	Crude oil and petroleum products; LNG; metallurgical coal; thermal coal; uranium

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 (2018)

Appendix B Glossary

Term	Description
ABS	Australian Bureau of Statistics
ABS	Australian Bureau of Statistics
AISC	All-In Sustaining Cost — an extension of existing cash cost metrics and incorporates costs related to sustaining production.
Base metals	A common metal that is not considered precious (includes aluminium, copper, lead, nickel, tin, zinc)
Bbl	Barrel
Bcm	Billion cubic metres
Benchmark	A standard specification used to price commodities.
BF and BOF	Blast furnace and basic oxygen furnace — used in an integrated steelmaking process that uses iron ore and coal.
Bulks	Non-liquid and non-gaseous commodities shipped in mass and loose (iron ore, coal, bauxite)
CAGR	Compound annual growth rate
CFR	Cost and freight — Seller clears exports, and pays freight.
Coal Seam Gas (CSG)	Natural gas found in coal seams. Also known as Coal Bed Methane (CBM)
Coke	Made by heating coal at high temperatures without oxygen, and used to reduce iron ore to molten iron saturated with carbon, called hot metal
Conventional gas	Natural gas that can be produced from reservoirs using traditional techniques. Contrasts with unconventional gas.
CPB	CPB Netherlands Bureau for Economic Policy Analysis
CPI	Consumer Price Index — measures quarterly changes in the price of a basket of goods and services which account for a high proportion of expenditure by the CPI population group (i.e. metropolitan households).

Crude steel	Steel in the first solid state after melting, suitable for further processing or for sale.
DES	Delivered Ex Ship — price of LNG including shipping and insurance.
DMO	Domestic Market Obligation — a policy to reserve energy commodities for domestic usage
ECB	European Central Bank
Economic growth	An increase in the capacity of an economy to produce goods and services, compared from one period of time to another. It is measured in nominal or real gross domestic product (GDP).
EIA	The United States Energy Information Administration
EAF	Electric arc furnace — a furnace that melts steel scrap using the heat generated by a high power electric arc.
ETF	Exchange Traded Fund — an exchange traded fund that allows investors to invest in gold on the exchange.
EUV	Export unit value — export value/volumes exported
f	Forecast — a two year outlook
FID	Final investment decision
FOB	Free on board — seller clears export, buyer pays freight.
GAD	Gross air dried basis — For measuring coal quality.
GAR	Gross as received basis — For measuring coal quality.
GBP	Great Britain Pounds
GDP	Gross Domestic Product — measures the value of economic activity within a country/group.
GFC	Global Financial Crisis — the period of extreme stress in global financial markets and banking systems between mid-2007 and early 2009.
Gj	Gigajoule
GST	Goods and Services Tax — a value-added tax levied on most goods and services sold for domestic consumption.

GST	Goods and Services Tax
HCC	Hard coking coal — The best grade of metallurgical coal used in the steel production process. Australian hard coking coal is regarded as the industry benchmark.
IEA	International Energy Agency
IMF	International Monetary Fund — an international organisation that promotes international financial stability and monetary cooperation.
IMO	International Maritime Organisation
IP	Industrial Production — measures the output of the industrial sector that comprises mining, manufacturing, utilities and construction.
ISM	US Institute for Supply Management
ISM	Institute of Supply Management
JCC	Japan Customs-cleared Crude (or Japan Crude Cocktail) — average price of crude oil imported by Japan and a common price index in long-term LNG contracts.
JFY	Japanese fiscal year
kcal/kg	Kilocalories per kilogram
kt	Thousand tonnes
ktpa	Kilotonnes per annum
LBMA	London Bullion Market Association
LCE	Lithium Content Equivalent
Li OH	Lithium Hydroxide
LME	London Metal Exchange
LNG	Liquefied natural gas

LPG	Liquefied petroleum gas
LVPCI	Low volatile pulverised coal injection — a type of low volatile coal used in the PCI process
m	Million
MMbtu	Million British thermal units
Mt	Million tonnes
mtpa	Million tonnes per annum
Nameplate capacity	The theoretical maximum annual production capacity
NAR	Net as received basis — For measuring coal quality
NDRC	China's National Development and Reform Commission
NEV	New energy vehicle — term used for plug-in electric vehicles eligible for public subsidies (battery electric vehicles and plug-in hybrid vehicles)
OECD	Organisation for Economic Co-operation and Development
OPEC	Organisation of Petroleum Exporting Countries
OPEC+	Informal term for agreements between OPEC and ten oil-producing countries which are not members of OPEC
Oz	Ounce
PCE	Personal Consumption Expenditure — a measure of the changes in price of consumer services and goods.
PCI	Pulverised coal injection — PCI coal is used for its heat value and injected directly into blast furnaces as a supplementary fuel, which reduces the amount of coke required.
PCI	Pulverised coal injection — a process used in blast furnace operations
PM	The afternoon price of gold set at 3.00pm each business day at the London Bullion Market Association
PMI	Purchasing Managers Index — an indicator of economic health for manufacturing and service sectors.

PPP	Purchasing Power Parity — a way of measuring economic variables in different countries that equalise the purchasing power of different currencies
RoW	Rest of world
s	Estimate — Incomplete data or subject to revision
Shale gas	Natural gas found in shales
SHFE	Shanghai Futures Exchange
SSCC	Semi-soft coking coal — A type of metallurgical coal used in the steel production process alongside hard coking coal, but results in a lower coke quality and more impurities.
Tariff	A tax on imports or exports that is used by governments to generate revenue or to protect domestic industries from competition.
Tight gas	Natural gas found in low quality reservoirs
TWI	Trade Weighted Index — a measure of the foreign exchange value of the US dollar against a basket of major foreign currencies.
UK	United Kingdom
Unconventional gas	Natural gas that is more difficult to extract, including coal seam gas, shale gas and tight gas. Contrasts with conventional gas.
US	United States
USD	United States Dollars
WEO	The International Energy Agency's World Energy Outlook
WTI	West Texas Intermediate crude oil price
z	Projection — a five year outlook

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